# FAO FISHERIES BULLETIN

Volume 4, Number 5 September-October 1951

## CONTENTS

RECENT PROGRESS IN THE CANNING OF FISHERIES PRODUCTS . . . 3

TRAWL FISHING IN THE BAY OF BENGAL . . . . . 28

QUARTERLY OUTLOOK FOR MARKETING FISHERIES PRODUCTS IN THE UNITED STATES OF AMERICA, OCTOBER-DECEMBER, 1951 . . . . 30

INTERNATIONAL INSTITUTE OF REFRIGERATION . . . . . 31

CONFERENCES AND MEETINGS . . . . . 32

FISHERIES DIVISION ACTIVITIES. . . . . 37

NOTES ON FILMS. . . . . 43

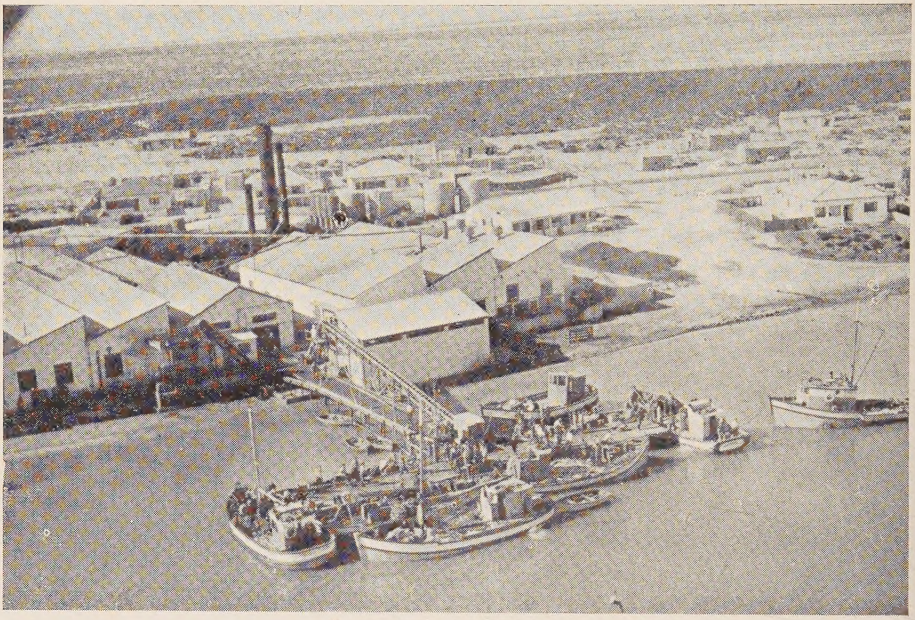
NOTES ON PUBLICATIONS. . . . . 45

---

*Editor:* D. B. Finn *Assistant Editor:* Anna Mae Singer Jul

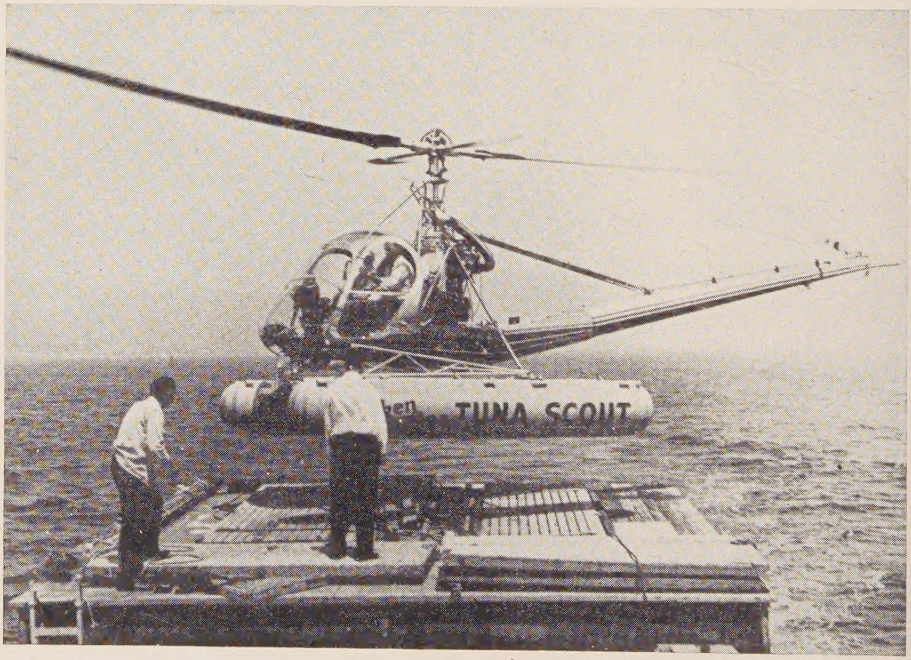
*FAO Fisheries Bulletin* is prepared by the staff of the Fisheries Division and published bimonthly by the Food and Agriculture Organization of the United Nations in Rome, Italy. *FAO Fisheries Bulletin* is published in English, French and Spanish. The contents have not been copyrighted and may be reprinted freely, but reference to source will be appreciated. Annual subscription U.S. $1.50, single copy 30 cents ; rates are payable in local currencies when orders are placed through local sales agents. See inside back cover for list of sales agents.

*Printed in Italy*



(Courtesy : *South African Shipping* and *Fishing Industry Review*)

*Figure 1.* Pilchard canning plant at the mouth of the Berg river in the Union of South Africa. This country has had a very rapid development of fish canning with the total production increasing from about 150 tons in 1939 to well over 10,000 tons in 1950.




Courtesy: *Pacific Helicopter. Co. (U.S.A.)*

*Figure 2.* Helicopter taking off from a tuna clipper. Helicopters and small regular planes are being used more and more by tuna boats, whalers, menhaden boats, etc., for the spotting of fish schools, whales, etc.

# RECENT PROGRESS IN THE CANNING OF FISHERIES PRODUCTS

*A paper presented at the Second International Congress on Canned Foods, held in Paris, 16-19 October, 1951. The Congress itself is reported on page 36.*

This survey covers the development of the canning of fisheries products since the time of the First International Congress on Canned Foods in Paris in 1937. These years have been a period of rapid progress for the industry. Canning of fisheries products was taken up in many areas where there previously was little or no such activity ; new products have appeared and many new methods and machines have come into use. On the whole, this represents such a variety of new developments that it is impossible to describe them all in the present study. It is hoped, however, it will at least fairly indicate the industry's progress.

Most of the information is based on special papers describing the progress of the canning industries in various countries. These papers were prepared for the Second International Congress on Canned Foods in Paris, 16-19 October 1951, by representatives of the following countries : Algeria, Australia, Belgium, Denmark, France, Israel, Morocco, Portugal, Sweden, Tunisia, Union of South Africa, United Kingdom and the United States. Further information has been collected from scientific and trade publications and from many personal communications which the author has received.

## Production

Not all countries have statistics which indicate their output of canned fisheries products. Even where such statistics exist, they are not always comparable. Some countries, for instance, indicate the net weight of the fish canned, others the total weight, including brine, cans, cases, etc. Some statistics do not distinguish clearly between canned and otherwise preserved fisheries products. Nevertheless, as Tables 1-4 show, remarkable progress has taken place in countries where production conditions are normal. The following examples illustrate this trend : the Union of South Africa produced 100 to 150 tons of canned pilchard in 1939, while the production in 1950 was well over 10,000 tons. Similar developments have taken place in other parts of Africa, notably Morocco, where there were 48 fish canning plants in 1938 and nearly 200 in 1950. Fish canning activities increased particularly along the Atlantic coast; for instance, the town of Agadir had no fish cannery at all in 1938, but had 54 in 1950. In the same way, in 1938, Algeria had 22 fish canneries, mostly of rather primitive design, without steam installations ; in 1951, it had 48 canneries with much improved equipment, all using steam processing.

The production of canned fish in Tunisia has increased so much that the country, which in 1938 imported 1,000 tons of such products, was able to export 3,000 tons in 1950.

Development has also been extremely rapid in Australia, where in 1950 the pack was 18 times as high as in 1938. Spectacular progress has taken place in Peru, where a very modern tuna, or bonito, canning industry was established during World War II. Production rose from virtually nothing to about 9,000 tons in 1950 and has been

TABLE 1 — TOTAL CANNED FISHERIES PRODUCTS IN SPECIFIED COUNTRIES, 1938 AND 1946-50

| COUNTRY | 1938 | 1946 | 1947 | 1948 | 1949 | 1950 |
|---|---|---|---|---|---|---|
| | Metric tons [1] | | | | | |
| Australia [2] | [3]273 | 471 | 1 686 | 5 547 | 4 938 | [4]3 157 |
| Belgium | [5]1 401 | 3 067 | 2 693 | 1 029 | 1 100 | 682 |
| Canada [6] | 47 850 | 77 870 | 91 823 | 54 234 | 43 224 | 45 576 |
| Newfoundland | [5]144 | 490 | 470 | 547 | 377 | 196 |
| Chile | ... | 2 750 | 2 184 | 2 318 | 4 558 | [7]4 500 |
| Denmark [8] | 2 350 | 1 690 | 3 935 | 7 100 | 7 900 | 7 850 |
| Finland | [5]30 | 400 | 450 | 500 | 400 | 400 |
| France [9] | [7]12 838 | 12 850 | 20 600 | 32 360 | 35 050 | 35 900 |
| French Morocco | [5]13 839 | [5]6 596 | [5]10 241 | [5]28 004 | 35 000 | 45 520 |
| Germany (Federal Republic) [10] | [15]28 151 | 583 | 1 643 | 7 900 | 16 200 | *17 000 |
| Iceland | [5]78 | 530 | 161 | 200 | 130 | 56 |
| Ireland | — | — | 70 | 404 | 298 | 18 |
| Italy | 7 700 | 9 300 | 12 250 | 8 500 | 5 759 | 6 300 |
| Japan | [5]100 969 | [11]1 825 | 2 250 | 4 167 | 6 136 | 38 737 |
| Netherlands | [5]554 | 4 090 | 6 870 | 6 195 | 6 900 | 5 575 |
| Norway | [7]35 970 | 25 310 | 36 110 | 50 120 | 42 470 | 33 390 |
| Peru [11] | ... | 2 652 | 4 618 | 4 872 | 6 199 | 8 721 |
| Portugal | [5]34 461 | 29 790 | 37 536 | 19 812 | 15 728 | 31 358 |
| Spain | ... | 49 956 | 35 457 | 32 957 | 48 836 | 61 775 |
| Sweden | 1 430 | 1 730 | 2 070 | 2 050 | *2 000 | *2 000 |
| Tunisia | [5]202 | 1 207 | 969 | 2 480 | 3 492 | 3 041 |
| Union of S. Africa and S.W.Africa [12] | — | 8 830 | 9 125 | 12 473 | 14 026 | *15 000 |
| United Kingdom [13] | 3 005 | 5 080 | 6 990 | 10 571 | 14 380 | 11 726 |
| United States [14] | 302 791 | 317 230 | 342 067 | 354 802 | 387 826 | 424 100 |
| Venezuela | ... | 7 789 | 7 477 | 9 273 | 7 700 | *7 000 |
| **Total** | ... | **572 036** | **639 745** | **658 415** | **710 627** | **809 578** |

*Source* : Official publications and communications.

NOTE : In addition to the above, the following figures are available : Algeria (1938) * 3,500 and (1950) 8,000 ; Brazil (1946) 591 ; Egypt (1946) 10 ; and Mexico (1946) 13,500. No other figures are readily available.

* FAO estimate

[1] Product weight, unless otherwise indicated.
[2] Edible weight ; excludes crustaceans, mollusks and fish paste.
[3] 1939.
[4] Subject to revision.
[5] Exports.
[6] Excludes Newfoundland.
[7] Herring and similar species and tunas ; true mackerels and similar species only.
[8] Excludes Faroe Islands and Greenland.
[9] Metropolitan France only, excluding Algeria and other overseas departments.
[10] Herring and similar species only.
[11] Salmon and similar species, herring and similar species, tunas, true mackerel and similar species only.
[12] Fiscal year, 1 November to 31 October.
[13] Excludes Northern Ireland and (in 1949 and 1950) Isle of Man.
[14] Includes Alaska.
[15] Pre-war Germany

growing steadily since. Many well equipped canning plants have been built and the industry has found a ready market for its products, mainly in the United States. Fish canning activities have also been

TABLE 2 — PRODUCTION OF CANNED HERRING AND SIMILAR SPECIES IN SPECIFIED COUNTRIES

| COUNTRY | 1938 | 1946 | 1947 | 1948 | 1949 | 1950 |
|---|---|---|---|---|---|---|
| | | | Metric tons[1] | | | |
| Belgium | 560 | 3 036 | 2 643 | 979 | 1 046 | 682 |
| Canada | 6 958 | 38 980 | 44 569 | 19 873 | 8 199 | 9 067 |
| Newfoundland | — | 54 | 45 | 303 | 222 | 26 |
| Chile | ... | *500 | 568 | 671 | 1 864 | *2 000 |
| Denmark[2] | 920 | 565 | 800 | 2 400 | 2 800 | 3 500 |
| Finland | ... | 400 | 450 | 500 | 400 | 400 |
| France[3] | [4]1 93 | 5 300 | 13 500 | 12 980 | 16 750 | 17 200 |
| French Morocco | [4]12 779 | *10 000 | *15 000 | *20 000 | 35 000 | 41 880 |
| Germany (Federal Republic) | 28 151 | 583 | 1 643 | 7 900 | 16 200 | *17 000 |
| Ireland | ... | *100 | 70 | 393 | 267 | — |
| Italy | 6 000 | 5 000 | 5 500 | 5 500 | 4 427 | 5 000 |
| Japan | [4]28 170 | 650 | 563 | 817 | 4 060 | 12 445 |
| Netherlands | ... | 2 800 | 4 000 | 4 500 | 5 000 | 4 000 |
| Norway | 35 500 | 24 900 | 34 600 | 41 100 | 35 000 | 23 800 |
| Portugal | [4]30 477 | 27 793 | 37 536 | 18 199 | 13 372 | 29 259 |
| Spain | ... | *10 000 | *10 000 | *9 000 | *10 000 | *10 000 |
| Union of S. Africa and S.W. Africa[5] | — | 3 420 | 3 454 | 5 319 | 7 488 | *10 000 |
| United Kingdom[6] | 3 005 | 5 080 | 6 990 | 10 571 | 14 380 | 11 726 |
| United States[7] | 59 130 | 98 312 | 68 541 | 93 932 | 145 200 | 181 800 |
| Venezuela | ... | 7 789 | 7 477 | 9 273 | *7 700 | *7 000 |
| **Total** | ... | **245 262** | **257 949** | **264 210** | **329 375** | **336 735** |

*Source :* Official communications.

* FAO estimate.

1 Product weight, unless otherwise indicated.
2 Excludes Faroe Islands and Greenland.
3 Metropolitan France only, except 1938.
4 Exports.
5 Fiscal year, 1 November to 31 October.
6 Excludes Northern Ireland and (in 1949 and 1950) Isle of Man.
7 Includes Alaska.

TABLE 3 — PRODUCTION OF CANNED SALMON IN SPECIFIED COUNTRIES

| COUNTRY | 1938 | 1946 | 1947 | 1948 | 1949 | 1950 |
|---|---|---|---|---|---|---|
| | | | Metric tons[1] | | | |
| Canada | 37 206 | 29 404 | 33 300 | 28 511 | 31 264 | 32 300 |
| Newfoundland | [2]18 | 29 | 22 | 125 | 87 | 85 |
| Denmark[3] | — | 40 | 40 | 30 | 50 | 50 |
| Japan | ... | 300 | 188 | 24 | 165 | 379 |
| United States[4] | 158 632 | 100 808 | 123 045 | 105 219 | 120 300 | 91 400 |
| **Total** | ... | **130 581** | **156 595** | **133 909** | **151 866** | **124 214** |

*Source :* Official communications.

1 Product weight, unless otherwise indicated.
2 Exports.
3 Excludes Faroe Islands and Greenland.
4 Includes Alaska.

considerably increased in Chile, but the development has not been as rapid as in Peru. This has probably been due mainly to Chile not having found such well established marketing channels as Peru.

The production in Denmark and the Netherlands also increased very significantly from 1938 to 1950. There, the industry could not be based on any previously unused fisheries resources, so that only a very close survey of the marketing situation made it feasible to manufacture new products.

Tables 1 and 2 show another interesting fact. Canning of herring in Canada and the canning of sardines in Venezuela reached a considerable volume during the war years and in the period of food scarcity

TABLE 4 — PRODUCTION OF CANNED TUNAS, TRUE MACKERELS AND SIMILAR SPECIES IN SPECIFIED COUNTRIES

| COUNTRY | 1938 | 1946 | 1947 | 1948 | 1949 | 1950 |
|---|---|---|---|---|---|---|
| | | | Metric tons[1] | | | |
| Canada | 14 | 2 100 | 1 707 | 1 312 | 660 | 293 |
| Chile | ... | *700 | 1 249 | 1 513 | 2 442 | *2 500 |
| Denmark[2] | 525 | 480 | 1 070 | 1 500 | 3 000 | 2 300 |
| France[3] | 10 900 | 7 550 | 7 100 | 10 980 | 14 900 | 17 500 |
| Italy | ... | 4 300 | 6 750 | 3 000 | 1 332 | 1 300 |
| Japan | ... | 875 | 488 | 313 | 749 | 20 739 |
| Netherlands | ... | 125 | 350 | 160 | 700 | 700 |
| Norway | 470 | 410 | 1 510 | 620 | 290 | 1 660 |
| Portugal | ... | 1 997 | *1 500 | 1 527 | 2 211 | 1 698 |
| United States[4] | [5]51 006 | [5]62 264 | 74 834 | [5]89 530 | 74 800 | 90 300 |
| **Total** | ... | **80 801** | **96 558** | **110 455** | **101 084** | **138 990** |

*Source* : Official communications.

NOTE : In addition, the following figure is available for French Morocco : 1950 — 1,820 tons. For Costa Rica in 1946, exports (indicative of production) amounted to 321 tons.

* FAO estimate.

[1] Product weight.
[2] Excludes Faroe Islands and Greenland.
[3] Metropolitan France only, except 1938.
[4] Includes Alaska.
[5] Includes jack mackerel.

immediately following the war. Now, the production has decreased very markedly. This is due neither to any disappearance of the fisheries resources, nor to the utilization of the catch for other products. Fishing activities have had to be curtailed simply because it was impossible to find a profitable market for the canned product. This means that, in effect, large food resources are left unused, in spite of the fact that there are fishermen who could catch them, and canneries which could process them and that the world has a very large food deficiency with many population groups being undernourished or even starving. This should be a challenge to fish canners and food technologists. It is not easy to make from herring and similar fishes canned products attractive to population groups unaccustomed to such food,

and still cheap enough to be within the reach of their income. Nevertheless, it is likely that much could be done in this field ; the problem is certainly of such importance as to merit close study.

## Fishing

A canning industry is always completely dependent on the availabi'ity of suitable raw materials. The supply problem is probably especially important in the fisheries industries where most of the production of raw material is subject to uncontrollable natural factors which often result in large and unpredictable changes in landings of fish. Just as vegetable and fruit canners have to be concerned with problems of plant varieties and growing conditions, the fish canner has to keep in close touch with the development of fishing techniques.

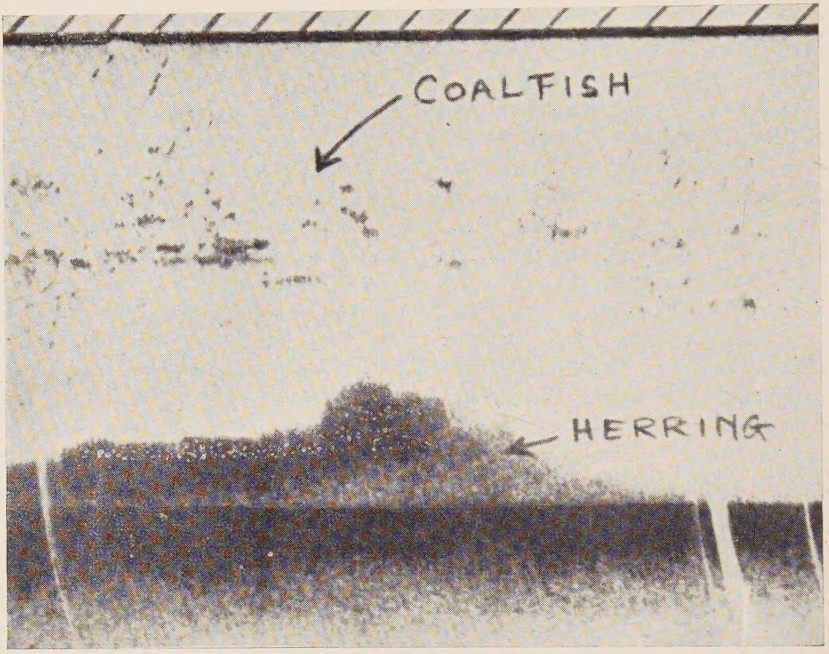
These techniques have undergone very interesting developments since 1938. Fi hing boats have been greatly improved. Especially noteworthy, so far as fishing for the canning industry is concerned, is the continuing development of the Californian tuna clipper which is now probably one of the world's most highly developed types of fishing boats. The cost of each unit often runs well above U.S $500,000.

Of even greater importance has been the development of fishing equipment. The increased use of *echo sounders* is a major advance. It has proved possible to use echo sounders not only to find fish shools, but also to determine their size, the direction of their movement and often even the type of fish in them. (Hodgson, 1950). In the Norwegian herring fishing fleet practically every boat is now equipped with an echo sounder, while the use of such equipment for fishing was practically unknown in 1938. The importance of this instrument is also indicated by the development in the Californian pilchard industry. Before the war, this fishery was carried out mainly on dark nights when the schools were spotted by the fluorescence they gave in the water ; fishing was practically stopped during periods of full moon. However, since echo sounders came into use, fish catches have been practically independent of this factor.

The use of *echo ranging equipment*, normally termed "Sonar " or " Asdic, " for fish detection is still in the experimental stage. However, investigations carried out by the Norwegian research vessel *G. O.Sars* (Devold, 1951), show that with Asdic it is possible to find and follow herring schools in mid-ocean in areas in which their whereabouts were previously almost unknown. The research vessel communicated its findings by radio telephone to units of the fishing fleet, enabling them to obtain very good catches in areas where herring had never been caught before. The great importance of such developments is obvious ; research in Norway is now concentrated on the development of a small, combined Asdic-echo sounder suitable for a fishing vessel.

Aircraft have also come into use for the spotting of fish schools. Many of the larger tuna boats, operating out of California, carry their own scouting plane (Coward, 1950). Such an aircraft can quickly cover

a much larger area than the boat itself. From it, it is possible to spot a tuna school, mainly by the presence of porpoises, at a distance of 32 to 40 km. (20 to 25 miles) while the range that can be covered from the




(Courtesy: Dr. W. C. Hodgson, British Crown Copyright)

*Figure 3.* Echo sounding chart showing how the location of coalfish and schools of herring can be easily detected by the use of this type of equipment which now finds very extensive application in the fishing industry.

crow's nest of a fishing boat hardly exceeds 3 to 5 km. (2 to 3 miles). It was by such aerial spotting that the presence of larger tuna schools was determined off the coast of Australia in surveys carried out immediately before World War II. Exploratory fishing carried out there in recent years with trolling and hook-and-line methods proved that good catches of tuna can be obtained. Australia is now in the process of establishing a canning industry based on this resource.

It is often overlooked that the very common use of the radio telephone has been a great aid to fishing industries. This facility makes it possible for fishermen to tell one another the whereabouts of large schools of fish also to advise coastal operators, canners, etc., in advance of the size of their catch, the time it will be landed, etc.

The importance of developments in fish detection is well indicated by the fact that fishermen's associations in several countries, for instance, Morocco and Sweden, operate special vessels equipped with all pertinent detection devices. These vessels scout for the main fleet and communicate their findings continuously by radio telephone.

Certain types of new fishing gear have also contributed to increased catches. For instance, the traditional drag nets or trawls, which are one of the most productive types of fishing gear, have the defect that they can only be operated close to the bottom of the sea. Many experiments have been carried out with the object of designing a trawl capable of being dragged nearer the surface. This, in theory, is quite an easy problem but it encounters numerous obstacles in practice. The problem seems finally to have been solved a few years ago by a Danish inventor, Larsen, whose floating trawl (Krason, 1949) is now in general use by fishermen in northern Jutland. The use of this gear is credited with very large increases in herring catches. Needless to say that where such gear is used, it is very important to follow the course of the fish schools with echo sounders so that the net may be dragged at the right depth.

The increased use of purse seines has also been important to the industry. This gear is now used very extensively in tuna fishing and has contributed to increased catches and more efficient operations. It has been tried for tuna fishing in Tunisia and Norway, where it proved to be very efficient and where it is expected soon to be in extensive use.

## *Factory Ships*

There is within the industry a continuing interest in the use of ships fitted with complete processing equipment, such as, for instance, canning machinery. While comparatively few such boats are in operation, it is always a very tempting thought that such factory ships can go right to the fishing grounds, process the catch while it is completely fresh and save the space wasted by having to transport unrequired parts of the fish.

However, when the technical and economic problems involved are considered, it is clear that the use of such boats is not easy to organize. For instance, a floating fish cannery factory must be completely equipped with all processing equipment, boilers, etc. and still must have hold space for the storage of supplies, fresh water, finished products, etc. In addition, it must carry quarters for the whole labor force for the canning plant. This labor force must be provided with food. The salary paid to such workers is generally considerably higher than that paid to shore workers, and must be paid over the whole period of the trip, not, as in the case of shore operators, only while the plant is operating. Finally, great difficulties are experienced in the transfer of the catch from fishing boats at sea. If the factory itself is equipped for fishing, greater fluctuations in the supply of raw material must be anticipated than in the shore plants, which can generally rely on the catch by a large number of fishing boats.

These considerations indicate that floating canning factories can only be operated economically where no possibility for shore operations exists. It is known that both Russian and Japanese salmon and

crab canning vessels have operated successfully in the northern Pacific Ocean. They may owe part of their success to the fact that the labor force used has very modest requirements as regards salary, food and living quarters. At present, the possibility of the operation of floating crab canneries is being investigated in the United States.

Thus, the operation of floating canneries is at the moment not extensive (Nickum, 1949). However, the developments in the whale and the tuna industries deserve mention.

Several British and Norwegian whaling companies are at present trying to organize the canning of part of the whale meat obtained in Antarctic whaling operations. Some companies have provided canning facilities aboard the floating whale factories, while others have installed such equipment in auxiliary vessels. In this case, the problem is more one of finding a product which will meet the requirements of the consumers who, so far, have been reluctant to accept whale meat in any form. A solution to this problem would be of great importance as a large part of the whale meat is now discarded and thus much potential food is lost.

Another interesting development, sometimes overlooked when factory ships are considered, is the fact that the Californian tuna clippers, and some of the larger tuna purse seiners, are normally equipped for freezing the catch aboard (Petrich, 1949). The fish are chilled in cooled sea water ; then refrigerated brine is circulated over them until they are completely frozen ; then the holds are emptied of brine and the fish kept in the frozen state by air refrigeration until landed. Some canners also operate carriers which freeze and transport the catch from the fishing fleet. These operations have been successful because tuna is unusually well suited for canning even after it has been frozen, and because, as a comparatively expensive fish, it can easily carry the added cost of the freezing.

## *Raw Material*

Important developments have taken place in the methods of supplying the canning factories with raw material. One new method is the use of pumps for unloading fishing boats, which is now in general use, for instance, in the Californian pilchard industry and in the Maine sardine canning industry in the United States (Tjilflaat, 1950). These pumps are capable of unloading from 100 to 300 tons of small fish per hour and require only two workers for the whole operation. It is generally considered that unloading by pumps takes only one-fifth of the time and manpower required for unloading by brailing. Some unloading pumps are said to be able to handle fish as large as 91 cm. (36 in.) in length. Their use may therefore be possible for fish other than herring and herring-like species.

Fish canners have always been faced with great fluctuations in the supplies of raw material. Many attempts have been made to even these out by preserving the fish by various means, especially by freezing. This method presents, however, two difficulties.

Firstly, freezing is quite expensive and therefore difficult to apply to cheap fish such as herring or pilchard. In addition, freezing does cause certain changes in the structure and flavor, which often make the canned product less attractive. As mentioned above, the freezing of tuna before canning is widely used. Raw material for the salmon canneries of Canada and the United States is also sometimes frozen, but it results in a somewhat less attractive canned product.

Experiments have been carried out quite extensively in Norway in using frozen sprats. It is said that it is now possible to use frozen sprats for canning, but as far as is known, the method has not yet been used commercially.

Large experiments are being carried out in the United Kingdom, especially at the Torry Research Station, in Aberdeen, aimed at the design of inexpensive freezing methods which would make it possible to preserve, in bulk, large supplies of herring for future processing, and various block freezing methods are being tested.

While so far it has proved difficult to do this by freezing, improvements have been made by the increased use of chilling and icing of the raw material. Extensive experiments have been carried out in California, France, Mexico and Norway. In Norway, for instance, it proved possible to extend the total keeping period of sprat from 4 to 6 days, from the water to the canning, by improved methods of icing.

In pilchard canneries in California and the Union of South Africa, successful use is made of refrigerating systems which circulate refrigerated brine over the fish in the storage bins, thereby increasing their keeping quality considerably.

## *Canning Operations*

Fish canneries have profited very substantially from progress made in canning techniques in general in recent years. They have particularly been subject to very considerable mechanization. It can in fact, be said that the canning industry in many countries has changed in the last decade from a handicraft to a modern industry.

The industry benefited greatly from the development, during World War II, of black plate and other substitute cans. They proved very difficult to use for most fisheries products, but intensive laboratory research and practical experimentation made it possible to adapt them, especially for products packed in oil, so that they could be used with satisfactory results.

The tin shortage also made it necessary to introduce electrolytic tinned plate, a development which proved so successful that it has become permanent. By helping to stretch the available tin supplies it is indirectly of great benefit to the fish canning industry.

Another development of lasting importance has been the increased use of aluminum containers, especially in the Scandinavian countries (Taarland, 1951). The fisheries industries of these countries had, in

fact, used such material long before World War II. Recently, very well designed processes for anodizing and lately also lacquering the aluminum plate in bands have reduced the corrosion problem to such an extent that aluminum has become the preferred material for the packing of several items.

It is generally known that the European canning industry before World War II to a certain extent lacked high speed and reliable can closing equipment. This was perhaps particularly true of the fish canning industry where the extensive use of rectangular and oval cans caused special closing problems. Very reliable equipment, has, however, been introduced in recent years, giving higher speeds and safer closure. The use of high speed equipment sometimes gives rise to some special problems because sealing the can very quickly after placing the lid on may cause overfilling and the bulging of ends. This has been solved in various ways, often by the increased use of clinching prior to closing.

Less extensive use has been made of vacuum closing equipment than was expected before World War II. As far as fisheries products are concerned, it is generally recognized that hot filling or exhausting, although more expensive and space consuming, gives a more constant vacuum and these methods are, therefore, now generally preferred. The quality of the can seems also to have been improved by the now almost general use of liquid sealing compounds.

Improvement is also due to the very wide use of mechanical can washers, for instance, in Portugal. Retorts and processing equipment have undergone very substantial improvements. In several countries, processing in open boilers was used quite extensively before World War II. Pressure processing is now always used and in Portugal, for instance, it has been made obligatory by law. Pressure gauges, thermostats, and recording equipment on the retorts have been considerably improved, also resulting in much improved keeping quality. The Scandinavian countries in particular have gone in for processing in water under counter- or super-pressure. The rather expensive equipment in use for this was found desirable on account of the extensive use of aluminum cans, and very satisfactory retorts have been manufactured (Nilsen, 1950). Other countries have also increased the use of pressure cooling, mostly by the use of compressed air.

Continuous retorts have, so far, found little use in the fish canning industry, probably partly because of the large amount of rectangular cans in use. The continuous retort recently developed in France (Durocher and Roskis, 1951), which uses a high water column to provide counter-pressure where cans are introduced or removed from the retort, might be of interest as it can easily be adapted to all shapes or sizes of cans. This retort seems similar to the one designed by a Norwegian company before the war. The latter was, however, never put into general use because of the danger of geyser effect by overcooking, because of rising temperatures, especially in the exit columns.

The safety of canned fisheries products, together with better retention of flavor and texture, have been improved by detailed studies of

processing conditions, heat penetration, thermal death times, etc., which have been carried out in many countries.

Fisheries products have also benefited from the more extensive use of cooler storage of canned products. This innovation is said to have considerably improved the texture of shrimp canned in Louisiana, U.S.A.

## *Sardines, Sprats, Herrings, etc.*

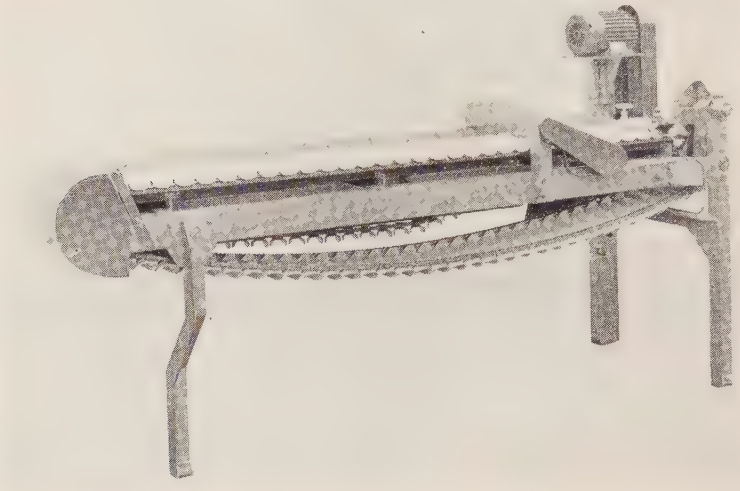
The canning of sardines and herring-like fishes mostly follows the same processes and uses equipment of more or less identical design (Huntley, 1951).

One of the principal problems is presented by the heading and gutting of the fish. This is quite a labor consuming process if carried out by hand, and it is difficult to design machinery to carry it out satisfactorily, although several types of machines were in common use in the Californian pilchard canning industry even before 1938. A machine of Californian design, using a vacuum suction principle for the removal of the viscera, has also been used successfully in South Africa. Machines from the United States have, however, not found acceptance in places where sardines, sprats or small herrings constitute the major part of the canning pack ; these species seem to be more delicate and more difficult to handle in machines than pilchards. In addition, it seems that as they generally are used for rather high priced products, higher demands are made with regard to the complete removal of the intestines.

The Norwegian sprat industry has been in the fortunate position that it generally, by impounding the catch, can free the fishes completely from feed before they are removed from the water thus making evisceration unnecessary. Sprat canners in other countries, the sardine industry and many herring canning factories have had to rely on evisceration by hand.

Recently, however, improved machines have been produced by the Arenco Company in Sweden, the Nordischer Maschinenbau in Germany (Wille, 1949) and by the Fisheries Research Board of Canada (Harrison and Roach, 1950). The latter has designed and patented an anchovy gibbing machine which is reported to work very satisfactorily. Machine heading and eviscerating is now used very extensively in the herring processing industries, where large herring are handled. It is used not only for canning, but also for products such as salted herring and herring or anchovy delicatessen. These products are not heat-processed and make, therefore, even higher demand on the complete removal of all bones from the fish (the bones are otherwise softened by the heat-processing). Special machines, which will not only bone but also fillet the fish, have been put into use by the delicatessen industries. Another machine to cut the herring fillets into small pieces, which are normally used for herring titbits, is now also used.

These machines have been widely used in the last decade in the herring industries, but have proved difficult to use for sardines, sprats or small herrings. In France and Portugal, sardines have generally been headed and eviscerated by hand. A great deal of work has been



(Courtesy : A. B. Arenco, Sweden)

*Figure* 4. A new heading and gutting machine especially adapted for sardines.

put into the arrangement of efficient cleaning tables equipped with mechanical conveyers, often adaptations of the Spanish Masso design. These innovations have led to very considerable saving in labor.

However, it should be mentioned that one of the modern French sardine lines, the Toquer line referred to below, uses a heading and gutting system which operates on the fish when it is hung by its tail on the racks in a conveyer system. It is understood that the users of this method are still experimenting with it. In addition, experiments on the design of eviscerating equipment for sardines have been continued. The latest reports from France (Durocher and Roskis, 1951) indicate that workers there have recently designed satisfactory equipment. It consists of a special roller grader for the size grading of the fish, which seems necessary for effective eviscerating of fragile species, and other machines for their orientation and feeding into the heading machine, otherwise a laborious operation. The line is said to be designed for a capacity of 100 to 120 fish per minute.

Other processes in need of mechanization are the washing, dry salting, and so-called rousing, or brining, of eviscerated fish. As regards washing, a machine has recently been introduced in France which washes the sardines on the usual frying grills under water jets. It proved to be more difficult, however, to find a satisfactory arrangement

for continuous salting or brining. A Norwegian machine has been put into use for the brining of sprats. It consists of a perforated cylinder with internal baffle plates, arranged in a spiral on the inside surface. When the cylinder rotates, partly submerged in brine, these plates move the fish forward. At the end, they lift them out of the brine and place them on a conveyer belt. The machine is very similar to the usual vegetable blancher. The standard models are based on a brining time of 8 minutes. Brining of sardines and herring generally requires 15 to 30 minutes contact with the brine. Machines of the design mentioned here would, therefore, have to be rather bulky and have been little used so far.

Most canning of sardines, sprats and herring-like fishes require the removal of a certain amount of moisture from the fish before the can is closed. In the Scandinavian sprat canning industry, this is generally carried out in combined smoking and drying ovens (Vesterhus, 1950). A special smoking tunnel, designed by the Kværner Co. of Norway, has been generally accepted in and outside Scandinavia. In Denmark, a rather simple smoking tunnel, designed by a fish canner, is being used by several plants. It uses drying and smoking in counter current air at an initial air temperature of 140° C. (244° F.) and an end temperature of 80° C. (176° F.). Direct fuel gases are used and 80% of the air is re-circulated. Originally the fish were carried through the oven on wire mesh trays by a conveyer system. As these left undesirable marks on the fish, they were replaced by steel plates with holes. Each hole has a wide slit in one side and a narrow slit in the other. The tail or the head of the fish is introduced through the holes and attached in either the large or the narrow slit according to its size. After drying, the heads or tails are cut off by moving a large knife across the plate, thus providing an easy method of releasing the fish.

In some countries, experiments have been carried out with electrostatic smoking. Quite extensive tests were published by the United States Department of the Interior, Fish and Wildlife Service (Hamm and Kust, 1948). The fish were placed in the open cans and passed through the smoking chamber on a metal conveyer belt. The smoke was produced by an ordinary smoke generator and chilled with a water spray for condensation of undesirable fractions. It was then led into the chamber over a grill which formed the positive electrode and was charged with about 20,000 volts. The cans and the conveyer belt, which were grounded, formed the negative electrode. Reports from tests of the product, both from the United States and elsewhere, indicate that its flavor was satisfactory, but it had not acquired the golden color normal for a smoked product. The process has not gained commercial acceptance in the United States. It is probable that electrostatic smoking has possibilities especially as an aid to smoking as carried out in the Scandinavian canning industry where fish are smoked while hung or laid individually on racks. This gives the possibility of a better contact with the smoke and thereby a better color.

It should be noted that recently a German company announced an electrostatic smoking apparatus which appears to be very similar to that tested in the United States. No information with regard to its performance has yet been received.

In the canning of sardines in France, Spain, Portugal, Morocco, etc. it has been customary to accomplish the removal of moisture from the fish by frying. In the orthodox process, this was done by placing the fish, tails up, on grills which were then immersed in hot oil or taken through a hot oil bath on conveyer belts. The oil was sometimes replaced by brine with much the same result. These processes are, however, rather cumbersome and expensive. During World War II, they were replaced with methods whereby the fish is steam cooked. After cooking, according to any of these methods, the fish have to be drained and dried. At present, this process is generally effected in air drying tunnels with forced air circulation (Boury, 1950). Where it is carried out in the open air, special regulations are generally enforced to prevent any contamination of the fish during drying.

The steam processes are difficult to adapt for continuous operation. The development in both France and Portugal has, therefore, aimed at cooking the fish in dry air. This is comparatively difficult to accomplish, as excessive drying of the surface of the fish readily occurs. However, several satisfactory processes have recently been designed, one of which is particularly successful, the Toquer process. One advantage of dry air cooking systems is that the drying period following the oil frying or steam cooking in the more traditional process can be dispensed with.

It appears that the difficulty of excessive surface drying in dry air cooking systems can be partly overcome by cooking in infrared light, which gives a very effective penetration of the heat. It is interesting to note that the rate of penetration can more or less be adjusted by the choice of wavelength. The wavelengths normally used are those close to that of visible light. Several cooking tunnels of this type are in operation in France (Boury, 1950). The infrared light emanates either from electric bulbs or from gas-heated steel tubes. The fish are generally conveyed through the tunnels on wire mesh trays. In this connection, the German process referred to below should also be noted.

One type of equipment which has been of considerable interest to the sardine canning industry is a packing machine wrapping individual cans in waxed paper. Such machines have long been available, but recently an inexpensive one has been introduced by the Lubecawerke of Germany.

## *Attempts to Mechanize the Processing of Herring and Similar Fish*

Brief reference has been made to the Toquer system, introduced in France in recent years. In this, (Le Procédé Toquer, 1950) the fish, previously brined, are clipped to a rack on a conveyer belt, carrying

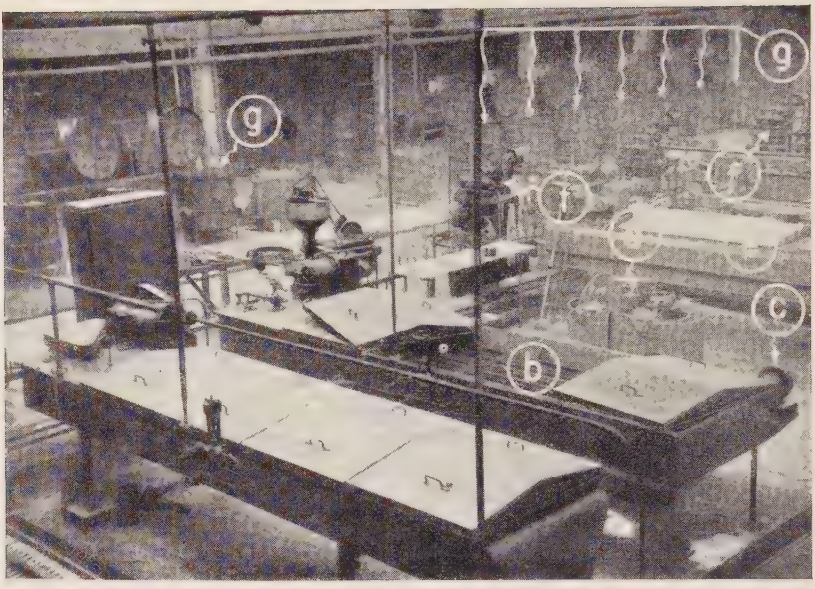
the rows of fish past a special beheading and eviscerating section, after which they are washed under a water jet-spray. The conveyer then passes through a hot air tunnel, for combined pre-drying, cooking and final drying. Where the fish leave the tunnel, special knives trim the necks and cut them into proper lengths. They are then carried by the conveyer to the hand packing tables. This type of equipment is reported to have worked successfully for several seasons. The process is in use in two plants in France.

Even more radical systems have been designed. They are based on packing the herring, raw, brined or unbrined, in the cans and carrying out the total process of drying, cooking, etc., while the fish are in the can. This is a great simplification as far as mechanical operations are concerned. Processes of this type have for many years been in use in the Californian pilchard industry. They were, however, extremely difficult to adapt in sardine canning where very high demands are made on quality and appearance (Boury, 1950). It is easy to see that it is difficult to prevent the fish from sticking to the sides of the can or one fish from sticking to another when there has been direct contact during cooking and drying. This problem seems to be particularly important in the canning of sprats and herring because these fishes generally are completely freed from scales. The scales, which remain on sardines, do to some extent contribute to the prevention of adhesion to the can.

Another difficulty is that of getting the fish uniformly cooked and dried when not hung individually or spread out in layers or rows on flakes or grills as in the traditional frying, cooking or smoking processes. It was only after many years of experiment that processes were worked out which were acceptable in the industry.

A third difficulty is that sardines and sprats, contrary to normal usage in the Californian pilchard industry, are mostly packed in oil. This requires that the product be sufficiently free from moisture to revent any separation of water during heat processing. This is very difficult to accomplish in any process which cooks the fish in the can.

One process of this type, the M. & P. machine, was introduced by the British Mather and Platt Company. The fish is beheaded, eviscerated and brined according to traditional methods. It is then hand-packed on modern conveyer-type packing tables in cans which previously have been given an oil coating on the inner surface by the use of a spray gun to prevent sticking. The packed cans pass on a conveyer belt through a hot air pre-drying tunnel which secures firmness of the skin, and afterwards by another conveyer into a similar tunnel where they are steam-cooked. The cans are then placed by hand on trays, covered with a wire mesh grill and put in a centrifuge rotating at 450 r.p.m. They pass into a second hot air tunnel to give the fish its fried taste and remove any surface water which has not been removed in the centrifuge. From there the cans go to traditional oil fillers, exhausters — where required— and closing machines. The capacity of this equipment as normally designed is 50 quarter club cans per minute. Several machines of this type are in successful oper-

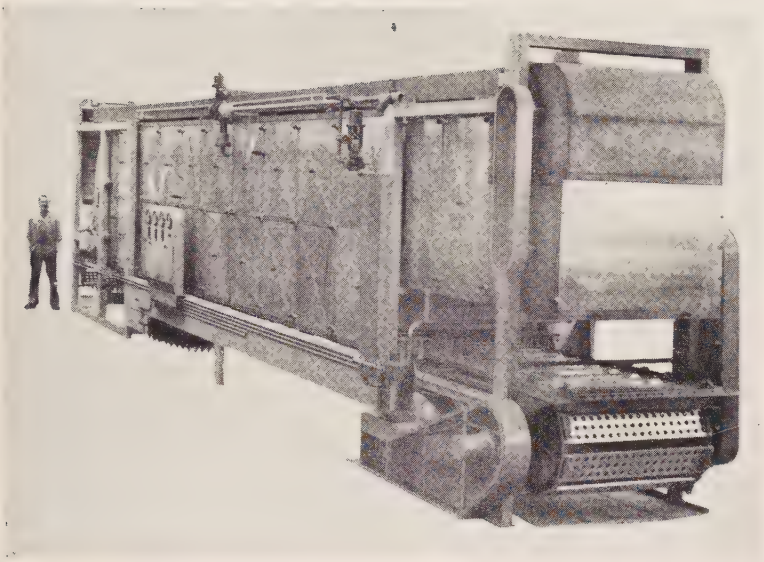



(*Courtesy:* S. A. Mather & Platt.)

*Figure 5.* Canning line for sardines developed by Mather & Platt Co. (*a*) Pre-drying section. (*b*) Cooking section. (*c*) Band for cooling. (*d*) Centrifugal separator for removal of water separated during cooking. (*e*) Final drying. (*f*) Closing machines. (*g*) Steam retorts.

ation. Five are in use in Morocco. One advantage of this method is said to be that it is rather flexible so that pre-drying, cooking, drying, etc., can be varied independently within wide limits.

An even more radical design, the IMC machine, has been developed by the International Machinery Corporation of Belgium (Cheftel, 1950 ; Roskis, 1950 ; Sanders, 1950). The beheaded and eviscerated sardines are packed immediately after washing in cans which have been sprayed with oil. The cans are then placed, generally in rows of eleven, on racks covered with a wire mesh grill and attached to the conveyer chains in the machine. Here a preliminary brine is added, whereupon the cans are inverted. This serves to remove blood and undesirable parts. When there are difficulties with the fish sticking together, the manufacturers recommend adding a small amount of acetic acid to the preliminary brine. New brine is now added and the cans are carried through a steam chamber where cooking is performed. Thus cooking is really carried out in brine. The cans are again inverted and dried or cooked first in the inverted position and later in the normal position in air. The cans are inverted once more to remove all liquid freed by the drying and the contents are dried again in the inverted position. This cooking and drying of the fish while the cans are being inverted several times serves to prevent sticking to the can sides and to accomplish a more uniform drying. Oil or



(Courtesy : International Machinery Corporation, Belgium)

*Figure* 6. Large fish canning unit. The unit handles fish which, after beheading and gutting, have been filled raw into the cans. In the machine the fish are washed in brine, cooked in brine, cooked in air, drained and dried in air. Then the cans are filled with sauce and exausted. The cans go right to the double seamer from this machine.

tomato sauce is added to the cans while they are still attached to the racks. The cans are then taken through an exhaust box, equipped with a jacketed ceiling which prevents drops of condensed water from falling into them. In some cases the exhaust box is left out. Instead, hot oil or tomato sauce is added to the cans. Where the cans leave the apparatus, steam jets clean the outside of fat. The racks are automatically removed from the conveyer belt and the cans are released and sent directly to the closing machine. The machinery is made in three sizes, for 25, 50 or 200 quarter club cans per minute. The equipment is already in extensive use ; 14 machines of this type are reported in operation in Morocco alone.

A type of equipment which should be mentioned here is the German Hartmann process by which the gutted, washed and brined fish, placed in open cans on hanging trays, are brought by a conveyer system through a long cooking tunnel. The cans pass under infrared electric bulbs. The tunnel has two such cooking sections, one above the other. Coming out of the last of them, the cans are inverted for draining. During this period they are covered by a plate with drains in it. They then go through a drying section which forms the third deck of the equipment. Too little is yet known about the performance of this machine to permit any comparative evaluation.

The development of a fourth machine of this type has recently been reported from Morocco (Meesemacker, 1951). It is designed by Daniel Bonnefont, of Agadir. No drawing of the equipment is available. It is understood that it dries the sardines packed in cans in a hot air tunnel, where the cans are inverted for part of the time. Air is introduced into the tunnel and re-circulated by high speed fans. The capacity of the machine is 25 quarter club cans per minute and is operated by two workers. The introduction of this machine is of such recent date that no report is available as to its performance. It is understood, however, that it is a quite inexpensive type of equipment, especially useful for smaller canneries.

The above-mentioned processes have so far been used mainly for sardines for which they were originally designed. It appears that they may find increased use for herring as well. Mather and Platt lines and some of the International Machinery Corporation machines are already in operation for herring, although an experimental run in the United Kingdom of one of the latter was discontinued. This was probably mainly due to the fact that this type of processing gives a higher percentage of shrinkage than normal herring canning. It is likely that the improved quality, which goes with this additional shrinkage, soon will make it possible for the product to attain the corresponding higher price. At least one machine of this type is operating successfully for herring in Belgium.

## Canning of Larger Fish

Comparatively little development has taken place regarding processing equipment for larger fish. However, in the production of canned tuna in France (Boury, 1950), the Toquer system mentioned above has been used very successfully. Here the fish, cut in steak-like pieces, are placed in a ring-shaped mould which is carried on a conveyer through the cooking and drying tunnel. The fish are then transferred from the mould directly into the cans. However, many canners claim that any process by which the tuna is cooked in steam or dry air gives less satisfactory products than cooking in brine where spices may be added.

For tuna, cooked according to traditional practice, a filling machine has been produced (Boury, 1950). Here, the cooked fish is placed on a rather long cylindrical mould which opens up sideways. The cylinder is then closed, a plunger presses the fish forward until the slices, which fit right into a can, can be cut off. A similar machine has been developed and put into use in the United States.

A product which has been developed in France during the period covered by this report is tuna packed in brine, so-called " au naturel. " The manufacture of this product has not given rise to any particular type of machinery, but has been well mechanized as regards the arrangement of cutting tables, conveyers, packing tables, etc. In addition, a machine to slice raw tuna has been designed in France.

For mackerel, special steaming machines have been designed in Denmark. One type is equipped with steam jackets, the fish being

placed in a chamber with a layer of water at the bottom. Another uses a bell-like chamber which is lowered over the rack with the mackerel and closed airtight with water.

Also related to the processing of larger fish are the automatic fillers for cod roe paste, packed in tubes, now used in Sweden. This product is not heat-processed.

## Crustaceans

Some progress has been made in canning crustaceans and has been reported in technical literature. In the United States, several automatic deveiners and graders have been introduced for shrimps. A shrimp grader has also been developed in Australia. The introduction in the United States of shrimp peeling machines may be important. The principle used in these machines is one of passing the shrimp over a layer of thin rollers. The shrimp is pressed against the rollers by rubber or leather fingers or springs. Sooner or later during the passage, a corner of the shell is caught by the rollers and torn off while the flesh passes over the rollers without being drawn into them.

An important improvement in the canning of crawfish was introduced in the Union of South Africa (Dreosti, 1949), where research has proved that the non-enzymatic browning of the canned product is generally due to reducing sugars. This sugar content can be reduced by soaking the crawfish in sea water for up to 15 minutes prior to canning. Soaking beyond this period should be avoided as it may lead to loss of flavor.

## New Products

It can hardly be said that any new canned fishery product, which has given rise to entirely new industries, has been produced during the last 12 years. Nevertheless, existing canneries have experimented with a large number of new products, some of which may become commercially important, such as the canning of boneless, or boneless and skinless, sardines in Portugal. This product has found a ready market in the United States.

Much importance is also attached to the development of a boneless and skinless salmon pack recently produced in Canada (Berglund, 1950), said to be very popular with consumers. Salmon canners have also experimented with the introduction of salmon croquettes and other speciality products.

Tuna canneries in the United States have put on the market a lemon-flavored tuna and tuna packed in jelly. One company has put up an entirely new canning line for strained tuna, which is being used as baby food.

Baby food is also being prepared in the United States from salted cod fish. The same company has put on the market canned cod, already soaked and ready for use. This product is designed to replace the

ordinary dried salted codfish which seems to be losing popularity, at least in the United States.

Californian pilchard canners have experimented with pilchards packed in a special ginger sauce, flavoring the pilchard with liquid smoke, and with dry packed pilchard in round cans, a so-called tenderloin pack, etc.

The canning of squid has been increasing in the United States and in Scandinavia. It is interesting to note that in Monterey, California, U.S.A., a port which is mainly known for its very large landings of pilchard, the total value of the landing of squid exceeded that of the landings of pilchard for the year 1946. In the Union of South Africa, canned green abalone is being produced (Dreosti, 1950). It was found that a preliminary salting of the abalone for 24 hours with subsequent soaking removed much of the usual toughness of the meat.

A similar salting process has proved advantageous in the Australian canning of *Arripis trutta*, the Australian salmon (Norton, 1951). It was found that the color of this pack, which often is brownish, can be considerably improved by addition of nitrite.

A new development in the United Kingdom is the canning of pilchard recently taken up in Devonshire and Cornwall. In Norway, a process has been designed aiming at the improvement of the flavor of canned herring. The pH of the product is adjusted to about 6, and a reducing agent, for instance, ascorbic acid, is added. Experiments have been carried out in many countries, for instance, in Denmark, with the use of monosodium glutamate, used in some canned products as a flavor improving ingredient, but no effect has been noticed, except for slight improvements in the case of fish balls and shrimp.

In Germany, the canning of herring fillets has increased very substantially and many new sauces have come into use. It is reported that sauces, completely stable during heat-processing, have been produced.

A special development of the greatest importance was the introduction, in Norway during World War II, of polymerized herring oil, the so-called sild oil, which was used very extensively for canning. During the war years, when no vegetable oils were available in Norway, this product was essential to canners. The product, when well prepared, is completely odorless and tasteless ; nutrition experts seem to agree that its addition is not objectionable from a health point of view. It is a very inexpensive canning oil and after a brief recess due to a certain reaction to war-developed " substitutes, " it is now being used quite extensively. It is said that certain markets even prefer this oil to the usual vegetable oils.

## Sanitation

As operations often have to be carried out in rather small plants, far removed from the main population centers, the fish canning industry has been a little slow in realizing the need for a high degree of hygiene and sanitation. However, the last decade has seen great improve-

ments in this direction. Fish canning plants are now mostly modern and well designed and all the necessary sanitary precautions taken. Wide use is made of the newly developed synthetic cleansing and wetting agents. Chlorination of water supply and cleansing water is very often used, together with a special chlorination arrangement for can cooling water.

Fish canners generally receive their raw material in returnable wooden boxes. These are difficult to clean and have recently been replaced in some instances by aluminum boxes or special kits ; where wooden boxes are used, they may be disinfected before being returned to the supplier. There is also a tendency, especially among Scandinavian sprat canners, to prefer the use of lower transport boxes where the damage to the fish due to pressure from layers above, is minimized.

In some sardine canning industries, non-metallic grills for sardines have been entirely replaced with iron trays, which are tinned yearly with special precautions to prevent any addition of lead to the tin solution. Special washing machines have been introduced for the cleaning of these trays between each use. These and other measures taken in Portugal have resulted in the elimination of lead traces from the product (Parreira, 1951). Thus, the fish is no longer cooked in the retorts used for the heat-processing of the cans, for fear of contamination from the lacquer on the outside of the cans, etc. Cans with soldered ends have been almost completely replaced with drawn cans or cans which have rolled-on ends. Another important step which has been taken in Portugal to improve sanitary conditions has been to forbid the reduction of waste, etc., in the same plant as that where the canning operation takes place.

## *Inspection Services*

The inspection services which various countries maintain to improve the quality of canned fisheries products have been considerably improved. A new fish inspection laboratory has been established in Canada. It not only carries out a very thorough examination of the canned products, but it also publishes recipes giving recommended practices for the canning of various products, etc.

Much of the improvement of the Portuguese canning industry has been carried out with the assistance of the inspection service of the laboratory of the Portuguese Institute of Canned Fish.

Tunisia has established an export grading of all canned fisheries products and the Union of South Africa has formulated very detailed standards for such products. These standards are not compulsory, but most canners find it to their advantage to comply with them. Both in Denmark and Sweden very extensive laboratory control and inspection systems for exported products have been recently established.

## Research

The industry has been materially aided by existing research institutions, most of which have been very considerably enlarged. Many new institutions have also been established. A few years ago, there was established in Sweden the Food Preservation Institution which serves the whole Swedish food industry and devotes much work to fisheries products.

Research work in this field has also been initiated in the United Kingdom by an experimental plant set up in Aberdeen by the Ministry of Food, and at the Herring Industry Board's experimental herring canning plant in Glasgow.

The Fishing Industry Research Institute, established after World War II in the Union of South Africa, has contributed very considerably to the remarkable development of the fish canning industry there.

A new fish canning research institute has been established in Vigo, Spain. The canning industry is also aided by the increased biological research activities regarding the availability of raw material, new fisheries resources, etc. Most notable here is probably the very large Pacific Oceanographic Fisheries Investigation program of the United States, which is aimed at the finding of new fisheries resources and the determination of the best fishing methods and grounds, etc., in the Pacific Ocean. The program is probably of particular interest to the tuna canning industry, which is also aided by the research work, planned by the International Tuna Commissions, established by Costa Rica, Mexico and the United States for the purpose of biological tuna investigations.

## Problems Ahead

Some radical new processes which may influence the canning methods of fisheries products very substantially are at the moment being investigated.

The use of X-rays, supersonic waves and cathode rays, etc., have always fascinated the food preservation industry. If a method could be found which would eliminate the need for heat processing, very great progress indeed would be possible in the field of food preservation. Interesting results have recently been obtained with the use of cathode rays. Short periods of radiation of fish in layers up to 5 cm. (2 in.) can render the fish flesh completely sterile. It has, however, no harmful effect on the enzymes which means that the fish is still subject to enzymatic deterioration (Heen, 1950). So far, no means have been found to overcome this difficulty.

Many fisheries products are quite easily damaged by excessive or even normal heat processing. There have been recent experiments in the United States with the addition of antibiotics to the canned products to reduce the required heat-processing. The treatment has not yet been found feasible for commercial operation, but the method

may, if developed, bring about very great improvements. Other countries have experimented with similar processes using other chemicals in minute quantities. Extensive preliminary tests have been very promising, but detailed information will not be released until further control experiments have been concluded.

## Conclusion

In comparison with other fisheries products, canned fish is extremely easy to store and distribute. This probably accounts for the fact that canned sardines and canned salmon have been very popular in many economically less developed countries. They are inexpensive, staple and acceptable to a great many consumer groups. There are still large unused amounts of fish supplies which are fitted for canning. It may be that more consideration has to be given to local taste preferences, etc. It is also likely that much of the work to be done is more one of getting markets organized and getting trade agreements and trade channels established.

It seems as if much wider use could be made of canned fisheries products also in economically more developed countries. It is worth noticing that several fisheries products, for instance, sardines, tunas, etc., are actually improved by canning. It is probable that this may be the case for other species, which are not, or only sporadically, canned at present. Here again, it is possibly a problem of marketing organization. In addition, the problem may be one of developing new products which better suit the modern housewife and the taste of the modern consumer. This is a field which offers a challenge, but also wide possibilities, for the food technologist and the fish canner who probably should co-operate with chefs and home economics experts.

When looking at the prospects for future development in the fish canning industry, one cannot help feeling impressed by the enormous difficulties which will be encountered. Many trials and errors must necessarily precede each little development or innovation, and even then, progress is slow, often so slow that it may discourage the workers in this field. But by reviewing the activities of the past years, as has been done here, it will be realized that from the chain of many small trials and maybe big errors, solid and steady progress has been made. Today, many more research workers, canning technologists, administrators, marketing specialists, etc., are working on the improvement and promotion of canned fisheries products. It seems that by the deliberate, co-operative effort of these expert workers, the progress in the years to come may be even more significant than in those here reviewed.

Mogens Jul

# BIBLIOGRAPHY


Berglund, M. They Engineered a Better Canned Salmon. *Food In-*
1950 *dustries* (McGraw-Hill Publishing Co., Inc., 330 West 42nd Street, New York 18), Vol. 22, No. 4, p. 44, April 1950. 3 pp., illus.

Boury, M. Evolution et progrès récents des procédés de fabrications des
1950 conserves de poisson en France. In *Congrès international d'étude sur le rôle du poisson dans l'alimentation.* Institut oceanographique, 195 rue Saint-Jacques, Paris. p. 176. 18 pp.

Cheftel, H. French Sardine Canners Keep Accent on Taste. *Food*
1950 *Industries* (McGraw-Hill Publishing Co., Inc., 330 West 42nd Street, New York 18), Vol. 22, No. 1, p. 86, January 1950. 4 pp. illus.

Coward, K. More Trouble for Tuna. *Pan American Fisherman* (Marine
1950 Press Publication, 205 Broadway Pier Building, San Diego, California, U.S.A.), Vol. 4, No. 10, p. 12, April 1950. 2 pp.

Devold, F. Po jakt efter storsilden i Norskehavet. *Fiskets Gang* (Fis-
1951 keridirektoratet, Bergen, Norway), Vol. 37, No. 20, p. 217, 17 May 1951. 6 pp.

Dreosti, G. M. Crawfish Canning: Tentative Suggestions. *Memoran-*
1949 *dum No. 23* (Fishing Industry Research Institute, Portswood Road, Cape Town, Union of South Africa), October 1949.

——— Canning of Abalone. Third Annual Report of the Fishing In-
1950 dustry Research Institute. *South African Shipping News and Fishing Industry Review* (South African Trade Newspaper (Pty) Ltd., P.O. Box 2598, Cape Town, Union of South Africa), Vol. 5., No. 7, p. 57, July 1950. 1 p.

Durocher, J and Roskis J. Progrès technique dans l'industrie des
1951 conserves en France au cours des dix dernières années. Paper prepared for the Second International Congress on Canned Foods, Paris, October, 1951.

Hamm, W. S. and Kust W. A. The Electrostatic Smoking of Sardines.
1948 *Fishery Leaflet No. 270* (U.S. Department of the Interior, Fish and Wildlife Service, Washington 25, D.C., U.S.A.).

Harrison, J. S. M. and Roach, S. W. An Anchovy Gibbing Machine.
1950 *Progress Reports of the Pacific Coast Stations* (Fisheries Research Board of Canada, Vancouver, British Colombia, Canada), No. 83, p. 40, July 1950. 2 pp., illus.

Heen, E. Litt om straalingskjemi og sterilisering ved elektrionstraaling.
1950 *Tidskrift for Kjemi, Bergvesen of Metallurgi* (Krongprinsensgt. 17 Oslo, Norway), Vol. 10, No. 8, p. 271, October 1950. 5 pp., illus., bibl.

Hodgson, W. C. Echo-sounding and the Pelagic Fisheries. *Fishery Inves-*
1950 *tigations* (Ministry of Agriculture and Fisheries, H. M. Stationery Office, London) Series 2, Vol. 17, No. 4, 22 pp., illus.

Huntley, J. G. The Canning of Herring. Paper presented at the FAO
1951 meeting on Herring Technology, Bergen, Norway, September 1950. Reprinted in translation in *Konserves* (Det Tekniske Forlag, Vester Farimagsgade 29, Copenhagen 29, Denmark), Vol. 9 No. 2, p. 13, February 1951, 8 pp., and in *Die Fischwaren- und Feinkostindustrie* (Elbe-Weser-Verlag, Dr. Seyfarth & Co., Bremerhaven-F, Germany), Vol. 23, No.8, p. 119, August 1951. 3 pp.

Krason, W. S. Floating Trawls. *Fishery Leaflet No. 343* (U.S. Depart-
1949 ment of the Interior, Fish and Wildlife Service, Washington, D. C., U.S.A.), June 1949. 5 pp. illus.

Meesemaecker Rapport sur l'industrie des conserves de poisson au
1951 Maroc. Paper prepared for the Second International Congress on Canned Foods, Paris, October 1951.

Nickum, G. C. Pacific Coast Fish-processing Vessels. *The Society of*
1950 *Naval Architects and Marine Engineers* (29 West 39th St., New York 18) photostat. 43 pp., illus., drawings. Partly reprinted in *The Fishing News* (Fine Technical Publications Ltd., 39 Wilton Road, London, S.W.1, Vol. 38, No. 1951, p. 15, 2 September 1950; No. 1952, p. 19, 9 September 1950; and No. 1953, p. 18, 16 September 1950.

Nilsen, K. A. Aluminium i Hermetikkindustrien. Johan Grundt Tan-
1950 num, Oslo, Norway.

Norton. Ch. E. Technological and Economic Advances in the Australian
1951 Canning Industry since 1938. Paper prepared for the Second International Congress on Canned Foods, Paris, October 1951.

Parreira, H. Recent Technical Progress in the Portuguese Canned Fish
1951 Industry. Paper prepared for the Second International Congress on Canned Foods, Paris, October 1951.

Petrich, J. F. The Tuna Clipper. *Marine Engineering and Shipping*
1949 *Review* (Simmons-Bordmann Publishing Corporation, (30 Church St., New York 7), Vol. 54, No. 7, p. 52, July 1949. 8 pp., illus.

Le procédé Toquer de traitement continu des sardines et autres conserves
1949 pour la mise en conserve. *L'Officiel de la conserve* (42 rue Pasquier, Paris 8) Vol. 5, No. 18, p. 30, December 1949. 3 pp.

Roskis, G. La Ligne IMC pour la fabrication des conserves de sardines.
1950 *L'Officiel de la conserve* (42 rue Pasquier, Paris 8.), Vol. 5, No. 22, p. 17, August 1950. 6 pp., illus.

Sanders, E. IMC-kokeren for urøkte sardiner. *Tidskrift for Hermetikk-*
1950 *industri* (Organ for de Norske Hermetikfabrikkers Landsforening, Stavanger, Norway), Vol. 36, No. 10, p. 515, October 1950. 5 pp., illus.

Taarland, T. The Development of the Aluminum Cans. Paper presen-
1951 ted at the Second International Congress on Canned Foods, Paris, October 1951.

Tjilflaat, A. Sildepumpen og erfaringene fra siste aars forsøk. *Fiskaren*
1950 (Norges Fiskarlag Strandkalen 6, Bergen, Norway), Vol. 27, No. 43, p. 1, 26 October 1950. 2 pp., illus.

Vesterhus, R. Procédés de conservation du poisson par le fumage en
1950 Norvège. Article in *Congrès international d'étude sur le rôle du poisson dans l'alimentation.* Institut océanographique, Paris.

Wille, O. Handbuch der Fischkonservierung. In the series *Der Fisch*,
1949 Vol. 3. Rudolf Baader, Lübeck, Germany.

# TRAWL FISHING IN THE BAY OF BENGAL [1]

As a first step in a plan to create a sea fishing industry in the Bay of Bengal, in 1950, the Government of West Bengal purchased two trawlers in Denmark and engaged crews to sail the vessels to India and to carry out fishing operations on arrival there. The vessels now named *Baruna* and *Sagarika* have the following specifications :

| | | |
|---|---|---|
| Original name | CHR. SCHRODER | SKARREKLIT |
| New name | BARUNA | SAGARIKA |
| Date built | September 1947 | July 1947 |
| Price paid after alterations | D. Kr. 425,000 (Rs. 292,286) | D. Kr. 435,000 (Rs. 299,586) |
| Gross tonnage | 75.84 | 91.98 |
| Length and breadth | 72 ft. 7 in. x 19 ft. 3 in. | 74 ft. x 20 ft. 7 in. |
| Type of engine | 404 V. 2-Stroke Valveless marine Diesel engine | 404 V. 2-Stroke Valveless marine Diesel engine |
| Horse-power | Gross 260 ; Indicated 240 | Gross 260 ; Indicated 240 |
| Speed | Loaded, 9 knots ; Unloaded, 10 knots | Loaded, 8-9 knots ; Unloaded 9-10 knots |
| Capacity of insulated and refrigerated fishhold | 55 tons of fish 35 tons of ice | 64 tons of fish 38 tons of ice |

The vessels left Denmark early in October and arrived in Calcutta on 12 and 13 December 1950 ; they commenced fishing on 26 December 1950. Since that date, until 3 June 1951, they had each made nine trips on which they were each absent from port about 85 of the 160 days and spent 67 and 64 days respectively fishing.

The entire gear used by the vessels was for trawling. The nets were the normal Danish trawl-nets for herring, prawn, haddock and flatfish, and were all cotton. Floating trawls, long-lines and other gear were also carried. The chief fisherman of the project reported that the haddock trawl was the best fishing net, while the flatfish trawl stood up better against sawfish attacks which had caused considerable damage to the nets. The damage caused by the sawfish was so great that much more repair and replacement work was necessary than had been expected, and special efforts at strengthening the nets were recommended.

Fishing was carried out chiefly on the eastern side of the head of the Bay, ranging from Eastern Channel to Gopalpur, in depths from 25 to 10 fathoms, mostly towards the shallower waters. Over most of the area the bottom was muddy, mixed on occasions with empty shell, sand, and, less frequently, with coral ; stone had also been met in a few localities. The skippers reported that the bottom was trawlable

[1] Based on material furnished by the Director of Fisheries, West Bengal, India.

everywhere, but that there were soft areas in which care had to be taken that the boards and net did not become embedded in the mud.

The most common fish in the catch was Silverbelly, (*Leiognathus* sp.) which at times was exceeded 80% of the catch. *L tjianidae*, *Sciaenïdae*, *Lethrinidae*. were also taken in fair quantities, but among the first quality fish, the most common was the Pomfret, (*Stromateus cinerius*). Prawns were also taken in fair quantity. There was a fair proportion of sharks and rays, most of which were inedible. All the catch was brought in, and about 95% of the landings were edible. There was some spoilage.

During the whole period, the vessels caught about 195 tons of fish. This gave a catching rate of 1.5 and 1.36 tons per day during the 67 and 64 days respectively each vessel operated. This rate was increased in recent trips to 2.19 and 1.89 tons per day.

Each trip involved 17.8 days in all, of which roughly 9.5 were spent at sea and 8.3 in port. Of the time at sea, two days per trip were occupied with steaming to and from the grounds. Since the project was a survey one, as well as a pilot commercial operation, some of the time at sea was spent in exploratory work. It was reasonable to assume that once commercial operations commenced, the vessels would be able to take their pay-load with fewer fishing days per trip on the average. On the other hand, it was obvious that the turn-around time — 8.3 days per trip — was too long and should be shortened. There is no doubt that much of the present difficulty arises from the fact that these vessels were operating alone. Once the number of vessels operating was increased, the servicing would become more efficient and the turn-around time less.

The landings from the first few trips were sold by the Government itself, but subsequently, they have been sold by contract. On an average, the catch brought in Rs. 20 per maund (about U.S. $ 116 per ton). This was half the amount anticipated.

The average monthly operating costs of the vessels, including fuel, provisions, pay of local staff, etc., were about Rs. 12,189. When insurance, depreciation and interest were added, the average total was Rs. 25.689. At Rs. 20 per maund, these costs meant that the vessels should land between them about 50,000 lbs. fish per month for sale to cover only the operating costs, and 105,325 lbs. per month to cover the total costs. Actually the landings disposed of had averaged 53,225 lbs. per month. or roughly half the amount required to cover the total outlay.

There is no reason to doubt that improvements cannot be effected quickly. The turn-around time can be shortened to give more fishing days per month ; probably more fishing hours per fishing day would also be possible, and there is no doubt that a commercial vessel, operating without obligation to undertake survey work, could not increase its actual fishing time above that possible from a survey vessel. It is probable that the overhead costs could be reduced and a better average price obtained ; possibly a greater proportion of the catch could be of first quality.

# QUARTERLY OUTLOOK FOR MARKETING FISHERIES PRODUCTS IN THE UNITED STATES OF AMERICA, OCTOBER-DECEMBER 1951

The U.S. Fish and Wildlife Service has now published its eleventh quarterly report [1] discussing the economic situation of the fisheries industry, with particular reference to the business prospects for the immediate future. These surveys play an ever increasing role in planning and appraising the fisheries industry, both from a national and an international point of view. Although late, a more detailed review of the content may be useful.

Under the heading "The Outlook at a Glance," major aspects of the market are summarized. In this section, a fairly heavy level of business activity is forecast for the fourth quarter of 1951, although some variation in the rate of activity is anticipated. Consumer demand was expected to be strong, with a consequent heavy demand for foods. Despite plentiful supplies of foods as a class, the market for edible fisheries products was expected to be fairly steady. However, the markets for by-products were not expected to be as satisfactory.

The rate of production in fisheries was expected to decline throughout the quarter, but cold-storage stocks were expected to build up until at least the middle of the quarter. Stocks of frozen fish and shellfish in cold-storage were expected to remain somewhat above normal levels. Market supplies of fisheries products were forecast as plentiful throughout the quarter. Exports of fisheries commodities were expected to be at a somewhat higher level than in recent months but still moderate in volume, while imports were likely to continue at a markedly high rate.

Four facts of major significance are highlighted in the report. These relate to peculiarities of the current supply situation at the writing of the survey and indicate trends which may be dominant influences in fisheries markets until next spring. These are: (1) Although the total cold-storage stocks of fresh frozen fisheries products were larger than those of a year earlier on 1 September, 1951, the increase in holdings was due primarily to the position of a few products, while holdings of more than two-thirds of the items had declined. (2) The very large supply of whiting in cold-storage as well as the continuing operation of the fisheries to produce whiting also plays a part. Stocks of whiting in cold-storage were about 80% larger than those of the previous year, and 40% larger than the same

[1] Russell, Ralph, *Quarterly Outlook for Marketing Fishery Products, October-December* 1951, Fishery Leaflet 336, United States Department of the Interior, Fish and Wildlife Service, Washington 25, D. C. (October, 1951). The present summary is based on an abstract by the author. An earlier issue of this series was used as one of the sources of information for the feature article in *FAO Fisheries Bulletin*, Vol. 4, No. 4, "Some Aspects of Recent Trends in World Fisheries."

period in 1949, a year when whiting was abundant. (3) The holdings of some 16 1/2 million pounds of ocean perch (rosefish) fillets, are about 60% larger than those of the previous year and about one-half larger than the 5-year average of holdings on 1 September. (4) The stocks of frozen shrimp, although unusually large, are not as great as those at the same time in 1950.

The market is expected to be strong for the following items : croakers, mackerel, sablefish or black cod, and canned salmon. Firm, or fairly firm, markets were anticipated for swordfish, canned herring, clams, canned crabs, oysters, lake trout, whitefish and yellow perch. The markets were expected to be steady, or fairly steady, for cod, flounder, sole, haddock, red snapper, fresh and frozen salmon, sardines, scallops, shrimp, blue pike, sauger pike, buffalo fish, catfish, bullheads and chubs. Markets for halibut were expected to be unsettled, as were those for salt herring, canned tuna, canned mackerel, carp, pickerel and yellow pike. Dull or slow markets were anticipated for whiting, ocean perch (rosefish), rockfishes, and canned shrimp, and weak for butterfish, sheepshead and suckers.

Among by-products, fish meal was expected to encounter an unsettled market, while that for fish oils and fish-liver oils would probably be weak.

## INTERNATIONAL INSTITUTE OF REFRIGERATION

The International Institute of Refrigeration, established by convention in 1920, covers all fields of refrigeration including applications to industry, the processing of food and agricultural products and the use of refrigeration in public health and medicine, and is charged with the following functions :

(1) to encourage the teaching of the science and practice of refrigeration and the development and promotion of studies and scientific and technical research carried out in this field ;

(2) to encourage the study of the best solutions to questions relating to the preservation, transportation and distribution of perishable goods ;

(3) to make known, giving sources of published information, the world situation concerning refrigerated goods from the three aspects of production, distribution and consumption ;

(4) to collate, with a view to publication, all scientific, technical and economic information and reports concerning the production and use of refrigeration ;

(5) to collate and study all relevant laws, regulations and information concerning refrigerating industries and, if desirable, to submit recommendations to governments for the improvement and unification of regulations concerning

the international distribution of those products to which refrigeration can be applied ;

(6) to organize international congresses of refrigeration ;

(7) to keep in constant contact with interested scientific and professional bodies in order to fulfil its plan of action.

The scientific and technical work of the Institute is in the hands of nine specialized commissions, directed by a technical board which includes, besides the chairman, and two vice-chairmen, the chairmen and vice-chairmen of the nine commissions. Recently, the Technical Board, the Executive Committee composed of one delegate from each of the 55 Member Governments, and a Working Party of the Executive Committee, reorganized the Institute, which has its central office in Paris. C. David was appointed Director in May 1951. *The Refrigeration Abstracts*, published by the Institute, are currently being revised.

*A.M.J.*

# Conferences and Meetings

## *International Council for the Exploration of the Sea*

This Council held its thirty-ninth meeting in Amsterdam, the Netherlands, 1-9 October 1951. The meeting was attended by 107 delegates and experts, representing the following countries : Belgium, Denmark, Finland, Iceland, Ireland, the Netherlands, Norway, Portugal, Spain, Sweden and the United Kingdom. Notice was given that the Federal Republic of Germany had applied for admission to the Council.

Dr. K. A. Andersson (Sweden) was re-elected as President of the Council and A.T.A. Dobson (U.K.) as its first Vice-President. Professor le Gall (France), K.U. Sverdrup (Norway) and Professor Lienesch (Netherlands) were also elected vice-presidents. Dr. P. Jespersen [1] of Denmark succeeded the late H. Blegvad as General Secretary.

The Northern Seas' Committee, under the chairmanship of A. V. Taaning of Denmark, discussed the results of biological and hydrographical investigations carried out in the northern seas during the last few years. It was decided that the question of international co-operation for further research work in the northern seas should be taken consideration by a special working group.

Reports on investigations regarding the effectiveness of various types of trawl gear were presented to the North Sea Sub-Committee by the English and Scottish delegation. Underwater photographs of a trawl in action, including film shots of trawling, were shown.

The North-western Area Sub-Committee discussed collaboration with the North-west Atlantic Fisheries Commission. Iceland reported

[1] *Editor's Note* : Dr. Jespersen died in December 1951.

on the stock of cod (year class 1945) and Denmark on West Greenland's fisheries, development (deep sea prawns and cod). The committee agreed that special emphasis should be laid on herring investigation. The *ad hoc* sub-committee on the Faroe Question will continue work. A small laboratory was established in Thorshavn this year. It will investigate age assessment of cod and other problems related to the work of the North-western Area Sub-Committee.

At a meeting of the North-eastern Area Sub-Committee it was agreed that Denmark, England and France would send research vessels to the Barents Sea whilst Norway and Scotland would pay attention to coastal areas.

The Baltic Area Sub-Committee tabled reports on hydrographical and biological investigations in the area. Denmark reported changes in the stock of fish contemporaneously to changes in salinity and temperature. Sweden reported hydrographical investigations in the Gulf of Bothnia. Other contributions dealt with plankton and eel investigations in the Baltic.

Members of the Transition Area Sub-Committee reported on investigations on the size of the stocks of the principal food fishes of the area. Special problems brought into discussion were : the transplantation of young plaice, the biology of prawns and lobsters in view of a better protection of the stocks, and the fluctuation of the stock of sprat regarding fishing intensity.

In the Atlantic Committee, under the chairmanship of Prof. le Gall, of France, papers dealing with the migrations of sardines and the influence of the temperature of the water and the wind were tabled by the French delegation ; the French delegation reported on ichthyometric and biological investigations on tuna ; and papers on the taxonomy of the various species of Merlucius and the desirability of new investigations were discussed. The committee agreed on a work program including investigations on the biology of the most important commercial clupeids, scombroids and thunids. It invited hydrographical investigations on the fishing grounds and the drawing of maps indicating the spreading of the various species over the fishing grounds.

In the European Atlantic Slope Committee, the Irish delegation tabled papers regarding the surface temperature of the sardines of Santander and Vigo. France reported on the stock of hake.

In the African Slope Sub-Committee, reports were discussed on ichthyological investigations in Morocco presented by the French delegation. The United Kingdom reported the establishment of a new research station at Kissy near Freetown, Gold Coast.

The Western Mediterranean Slope Sub-Committee decided to terminate its activities.

The meeting of the Pelagic Fishes Committee was devoted to the reading of papers regarding tagging experiments. Reports on the recapture of tagged herring were received from Belgium, Denmark, France, Iceland, Norway, Scotland and Sweden. The committee recommended that as a direct means of showing the dependence of fish stocks on hydrographical conditions and as a direct help to the fisheries,

experimental fishing on a commercial scale should be carried out simultaneously with hydrographical observations.

The Herring Sub-Committee decided to conform to a common plan for searching for herring in the Icelandic-Norwegian area during May-June 1952. Danish, Icelandic, Norwegian and Swedish research vessels would participate in the work. The sub-committee recommended the collection of information on the use of echo-sounders and Asdic equipment for commercial fishing and scientific purposes.

The Hydrographical Committee, under the chairmanship of K.U. Sverdrup of Norway, received reports on the hydrographical activities of member countries and discussed improvements on hydrographical techniques. A special sub-committee was constituted for promoting measurements of currents.

Following Dr. Jespersen's appointment as General Secretary of the Council, T. Braarud (Norway) was elected Chairman of the Plankton Committee. Members reported on plankton observations in the North and the Baltic Sea and discussed the desirability of distributing plankton recorder results in the same way as the charts on temperature and salinity conditions in the North Sea are distributed. Professor E. Steeman Nielsen reported on a new method to measure the production of organic matter in large bodies of water by using radio active carbon. It is possible that this method will allow more accurate measuring of the production of fish food than possible heretofore.

Members of the Salmon and Trout Committee reported on the results of the second three-years' salmon tagging program. Recapture of tagged fishes was reported from France, Ireland, Norway and Scotland. Attempts will be made to survey the results so far achieved by drawing general charts showing the courses taken by the fishes. The desirability of protecting salmon in the open sea was considered and the need for more effective statistics stressed. Dr. W. F. Thompson of the University of Washington read a paper on salmon research.

In the Crustacean Section of the Shellfish Committee, members of the Committee reported on investigations concerning the effectiveness of various types of gear for shrimp fishing. The need for statistical investigations carried out for promoting a better knowledge of the influence of fishing on the stocks of shrimps was stressed. The Mollusca Section discussed the culture of oysters and other marine organisms and surveyed the results of research work in various countries. The Chairman of the Committee was Dr. B. Havinga of the Netherlands.

The Chairman of the Statistical Committee, N. Rosen of Sweden, reported on progress made with the 1948 and 1949 editions of the statistical publications of the council ; the 1948 edition is almost ready for printing. It was decided to give statistics on a round weight basis in the future.

W. H. Schuster attended the meeting as FAO's observer on biological matters, whilst G. M. Gerhardsen acted as an observer on statistical affairs.

*W.H.S.*

## *International Commission for the Scientific Exploration of the Mediterranean Sea*

The second post World War II meeting of the Commission was held in Monaco, 20-22 September 1951. France (including Algeria), Greece, Italy, Morocco, Spain and Tunisia, have indicated that they wish to continue to be members of the Commission. The United Kingdom has officially resigned. The Commission officers elected in February were re-elected. These were : Chairman : Ambassador Ugo Sola (Italy), Vice-Chairmen : Dr. Hussein Faouzi (Egypt), Commander Rousch (Monaco), Admiral Rodriguez (Spain), General Secretary : Professor Jean le Gall (France).

Co-operation with other international organizations, including the International Council for the Exploration of the Sea, was discussed. A scientific committee was appointed to establish panels to study specialized questions. It was hoped that funds would allow the annual issuance of the bulletin of the Commission. R. H. Fiedler and M. Girard representing FAO, attended the meeting and discussed the possibilities of co-operation between FAO and the Commission.

*R. H. F.*

## *Comité international permanent de la conserve*

This Committee (C.I.P.C.), held its second annual meeting in Paris, on 15 and 20 October 1951, mainly for the purpose of discussing arrangements for, and resolutions adopted at, the Second International Congress on Canned Foods mentioned below.

The Chairman of the Committee for Standardization, P. Peissi, reported on the work of the standardization of various cans, including fish cans ; some proposals had already been transmitted to the International Standardization Organization which is officially considering the proposal made by the C.I.P.C.

The Chairman of the Scientific Committee, H. Cheftel, reported on the work of this Committee. One of their most important tasks was to examine different analytical methods for canned foods ; some proposals were already prepared for various food analyses. These were now being tested by research institutes co-operating with the C.I.P.C. A sub-committee was discussing the problem of the international adoption of a standard designation of fish names as indicated on the labels of the cans. The Committee found that it was unable to arrive at any agreement regarding use of the designations " sardines " and " anchovies. " Some preliminary arrangement was reached with regard to the use of the designations " tuna " and " white tuna." The Committee was collecting information on laws and regulations of various countries on the designation and standardization of canned fisheries products.

Following resolutions adopted by the Second International Congress on Canned Foods, the C.I.P.C. established several new committees, one on the question of canned foods' legislation, one on the development of new machinery for the canning industry, and one to assemble material on the advantages of the use of canned foods.

It was decided that the C.I.P.C. would hold its next meeting in Spain in the autumn of 1952.

*M.J.*

## *Second International Congress on Canned Foods*

This Congress, organized by the above-mentioned C.I.P.C., met in Paris on 16-19 October 1951. The President of the Congress was the President of the C.I.P.C., R.V. Manaut. The Secretary-General was P. Peissi, and countries represented included Algeria, Australia, Belgium, Denmark, France, Germany (Federal Republic), Israel, Morocco, the Netherlands, Norway, Portugal, Spain, Sweden, Tunisia, Union of South Africa, the United Kingdom and the United States.

One afternoon's meeting was devoted to questions of nutrition and the nutrition value of canned foods, with the following papers presented : " Importance of Preserved Food in World Nutrition, " by Dr. A. G. van Veen of the Nutrition Division, FAO ; " Review of Research on Nutrient Retention during Canning, " by Dr. L.E. Clifcorn, United States ; " Digestibility of Canned Foods, " by Mrs. Cannepin, France.

One day was devoted to reports on technical progress in the canning field since the First International Congress on Canned Foods in Paris in 1937. General developments in canning methods, especially as regards heat-processing, were summarized by Dr. C.O. Ball and Dr. B.S. Clark, both from the United States. The technical developments in the canning of fisheries products were summarized by Mogens Jul, Chief Technologist, Fisheries Division, FAO. This paper is reproduced on pages 3 to 25 of this issue.

One morning's meeting was devoted to aspects of food laws and regulations in various countries with papers presented by C.H. Bloedorn, United States, and Dr. C.L. Hinton, United Kingdom.

One afternoon's session was devoted to recent studies on cost and availability of canned foods compared with fresh, frozen and home-cooked foods. The same afternoon another section held a meeting on the bacteriology of deliberately non-sterile canned foods. Dr. V. Aschehoug, Norway, presented a paper on the bacteriology of herring delicatessen and other non-heat-processed fisheries products packed in cans.

Another morning session was devoted to progress in canning containers, with papers on plate, aluminum, etc.

Among the resolutions adopted by the Congress was one recommending that the C.I.P.C. endeavor to arrange a third international congress on canned foods in 1956.

The report from the Congress will be available to all participants from the General Secretary, 3, rue de Logelbach, Paris 17.

M.J.

## *Eighth International Congress of Refrigeration*

This Congress was held under the auspices of the International Institute of Refrigeration in London, 29 August-11 September, 1951. The chairman was Lord Bruce of Melbourne.

During the Congress, lectures were given on refrigerating machinery and engineering, construction of cold-storage plants, the effect of chilling and freezing in biological systems, refrigerator transport by rail, truck and ship, as well as the following papers on the preservation of fish :

(*a*) " The Preservation of White Fish at Sea, " by Dr. G. A. Reay (United Kingdom).

(*b*) " Results of Methods of Testing the Keeping Quality of Chilled Fillets of Cod and Attempts to Systematize Organoleptic Testing Methods, " by F. Bramsnaes (Denmark).

(*c*) " Some Means of Retaining Quality in Fresh and Frozen Fish, " by O. C. Young (Canada).

(*d*) " Experiments on the Freezing of some Dutch Fishery Products, " by C. J. van den Broek (Holland).

(*e*) " Use of Ethyl-gallate as an Antioxidant in the Freezing of Eels, " by C. J. van den Broek and F. D. Tollenaar (Netherlands).

(*f*) " Contact Freezing of Fish Fillets between Parallel Plates, " by A. Watzinger (Norway).

Numerous excursions were arranged for the 300-400 delegates to cold-storage plants in England and Scotland, a private fish plant in Grimsby, the Low-Temperature Research Station in Cambridge, the National Physical Laboratory, Teddington, the Torry Research Station in Aberdeen, as well as to many other places. Mogens Jul attended as an observer from FAO.

*A. M. J.*

# Fisheries Division Activities

## *Regional Fisheries Council for Latin America*

Representatives of Brazil, Chile, Colombia, Costa Rica, Cuba, El Salvador, France, Mexico, the Netherlands, Nicaragua, Panama, Peru, United Kingdom, the United States and Uruguay, along with observers from Argentina, Bolivia, the Dominican Republic, Ecuador, Venezuela, the Inter-American Tropical Tuna Commission and the International Commission for the North-west Atlantic Fisheries, convened in Lima, Peru, 17-22 September 1951, to discuss the establish-

ment of a Latin American Fisheries Council on the lines of FAO's Indo-Pacific Fisheries Council. Under the chairmanship of J. Cesar Gonzales la Hoz, Head of the Peruvian Delegation, the meeting adopted a resolution recommending the establishment of a fisheries council in the Latin American area. The meeting also recommended a draft agreement which is being submitted to the FAO Conference for approval and then to the interested governments for ratification. The Council will come into being as soon as the agreement is ratified by five Member Governments of FAO of the area. Other officers of the meeting were : vice-chairman, Prof. Enrique Beltrán, of the University of Mexico, and Secretary-General, Dr. Herbert Mulanovitch, of Peru. The FAO Secretariat in attendance were Dr. D. B. Finn, Dr. Osorio-Tafall and H. C. Winsor.

Two seminars were organized during the meeting : one on " Sustained Yield in Fisheries," with Dr. Harrington as moderator, and another on " Problems of Latin American Fisheries, " with Dr. Osorio-Tafall as moderator. The delegates to the meeting made trips to the nearly completed Fish Terminal in Lima, to the Fisheries Technological Laboratory at the fish pier in Callao, to the Santa Eulalia hatchery and to the tuna cannery in Chancay.

## *Interim Committee on Fish Handling and Processing in North-western Europe* [1]

This Committee, established at the FAO Meeting of Fisheries Technologists in Bergen, Norway, 29-30 September 1950, met in London, 5-6 September 1951, to discuss the establishment of an organization for the purpose of stimulating and/or co-ordinating studies aimed at the improvement in the handling and processing of fish, mainly in North-western European countries, and establishing working groups of the committee. Members of the Committee are : Dr. C. J. van den Broek, the Netherlands ; Erik Heen, Norway ; Dr. G. A. Reay, United Kingdom, who were all present. Prof. J. le Gall (France), who was unable to attend, is also a member ; Dr.P.O. Creache attended the meeting in his place. Dr. G. Borgström, Sweden ; F. Bramsnaes, Denmark ; Dr. Cutting, United Kingdom ; and Otto Young, Canada, attended as observers. Dr. Reay was elected chairman. The Committee decided to continue to act as an interim body and to work through working groups which it established, and through its officially appointed technical contacts in the various countries. The working groups are : (1) Herring Products for Consumption in the Tropics, Chairman, Dr. Cutting ; (2) Pre-packed Herring Products, Chairman, Dr. Borgström ; (3) Extension of the Application on the Freezing

[1] *See FAO Fisheries Bulletin*, Vol. 3, No. 6, pp. 144-45 and Vol. 4, No. 4. p. 35.

of Fish, Chairman, Erik Heen ; (4) Improvement of the Methods of Chilling Fish, Chairman, F. Bramsnaes. Mogens Jul acts as Secretary of the Interim Committee.

## *Meeting on Food and Agricultural Programs and Outlook in the Near East*

Representatives of Egypt, Ethiopia, France, Iraq, Jordan, Lebanon, Pakistan, Saudi Arabia, Syria, Turkey and the United Kingdom, with observers from UNESCO, United Nations Relief and Works Agency, the U.N. International Children's Emergency Fund, the Near East Foundation, and the International Labour Organisation, met under the auspices of FAO in Bloudane, Syria, 28 August to 6 September 1951, to discuss the food and agricultural situation in the Near East. FAO Fisheries Division was represented by M. J. Girard, recently appointed Regional Fisheries Officer for the Near East. Among the extensive discussions on the current situation, and on FAO's work in the Near East, were general discussions on the fisheries of the area where the fisheries industry is far from the state of development which it should have reached and which its importance demands. Many countries have already made considerable efforts to increase the production from their seas, but a great deal remains to be done for sea as well as for inland fisheries and for fish culture. A fully developed fisheries industry would greatly help to improve the nutrition situation of the Near East where animal protein production is not only insufficient but also open to serious fluctuations ; moreover, such development would aid economic stability. The meeting recommended, therefore, that FAO give all possible support to the development of fisheries in the Near East ; that in each country fisheries services be given all the means of action needed and, where such services do not exist, they be created ; and that an FAO fisheries official study the problems peculiar to each country on the spot with the competent authorities. As a result of these recommendations, it was arranged for M. J. Girard to leave on 15 October 1951 to discuss problems of the fisheries industries with officials of Egypt, Iraq, Lebanon, Saudi Arabia and Syria. He was to assist these countries in formulating requests for technical assistance from FAO.

## *International Meeting on Fisheries Statistics*

This meeting was to have been held in Rome in November 1951, but was postponed to 26-31 May 1952. It will be held in Copenhagen, Denmark, in co-operation with the host government. As similar meetings are planned for other regions, the May meeting is expected to be attended mainly by statisticians from North America, Europe and adjacent countries in the Mediterranean area. Papers to be presented at the Copenhagen meeting are being completed and

circulated to the participants. It is expected that the meeting will be attended by technicians actually in charge of the statistical work in their home countries and that they will concentrate on practical problems of extending the coverage of these statistics and increase their international comparability.

## Training in Fisheries Statistics

Training of fisheries officers in statistical techniques is one step towards the improvement of fisheries statistics. A pilot training course in fisheries statistics was held in Bangkok for Thai fisheries officers, 16-24 August 1951, preliminary to a course to be held in 1952 for fisheries officers of the Indo-Pacific area. The objective of the course is to introduce fisheries officers to the simple basic rules and concepts of fisheries statistical programs and to give them the essentials in the elementary techniques to be applied. The preliminary course, organized by Dr. Kesteven and his staff, assisted by L.P.D. Gertenbach, was intended as a test of the suitability and efficacy of the structure of the proposed course, to give Thai officers some prior training for the course, and to assist in the selection of Thai officers to act as guides and interpreters to visitors at the course.

The preliminary course consisted of three series of lectures on the fishing industry, including a description of its structure, definitions and terms, and an account of governmental activities ; a general introductory account of statistical theory and methods ; and statistical practice. The trainees were given a schedule of observations to be made and recorded during the months immediately following the course, and it is intended to arrange an examination and review of this work sometime during November or December. In addition, it is proposed to arrange a short field exercise for the selected trainees as rehearsal in the field work to be done during the course proper. Summaries of the lectures were prepared in English and in Thai.

In co-operation with the Government of Finland, the U.N. Statistical office, the International Labour Organisation and the Economic Commission for Europe, FAO arranged a seminar on statistical techniques in Helsinki, Finland, 5-15 September 1951. F. Rosenfeld, statistician of the FAO Economics Division, gave a lecture, prepared in co-operation with the Fisheries Division, on the collection and analysis of fisheries production and trade statistics. The lecture also summarized international action in this field.

## Indo-Pacific Fisheries Council

The Council recently issued the first two numbers of an *IPFC. Current Affairs Bulletin.* The Bulletin, which summarizes fisheries progress and new developments in countries of the Indo-Pacific area, is prepared on the basis of information received through official communications, press notices and the personal knowledge of the IPFC

Secretariat and is intended to keep fisheries workers of the region informed of current fisheries activities. Governments are taking steps to appoint administrative correspondents for the Bulletin. The IPFC also recently issued a paper by D. J. Rochford, Chairman of the Biological Committee, on " The Present Status of Oceanography in America, " which includes organizations carrying on oceanographic work. Dr. Kesteven recently visited Manila and Hong-Kong to discuss fisheries development there, and to discuss co-operation with UNESCO on projects in the area.

## Research Workers and Institutions

The work of compiling a catalogue of fisheries research and educational institutions of the world [1] is being continued and has been expanded to include a registry of fisheries research workers. H. Rosa Jr. is currently collecting information for the section on Europe, Africa and Near Eastern countries in Asia. Questionnaires have been sent to the National FAO Committees in these areas requesting that they be forwarded to the competent fisheries institutions. The questionnaire provides for information on the administrative structure, field stations and laboratories of the organization, names and type of investigation being carried on by research workers, equipment and laboratory facilities, research vessels, educational facilities and type of degree offered and publications issued by the organization.

## Fish Processing

Fish processing problems and programs in several countries of the Indo-Pacific region will be studied by Dr. E. Hess on a visit to these countries beginning 27 October. He will discuss local processing problems with fisheries officials in Burma, Hong-Kong, India, Indo-China, Pakistan, the Philippines and Thailand. He will devote special attention to the dried fish industry and the formulation of a program for technological research in East Pakistan ; to the manufacture of fish sauce, salted fish, and salted and dried fish and pastes in Indochina ; to plans for technical courses for fishermen, the marketing of fish and the work of the fisheries experimental station in Hong-Kong ; and to plans for holding an international fisheries technological course for the Indo-Pacific region at the Fisheries Technology School in the Philippines.

## International Fishing Boat Conference

Following the publication in *FAO Fisheries Bulletin*, Volume 4, No. 1-2, of the article " Improvement of the Design of Fishing Boats, " it was suggested by experts in various countries that FAO organize

[1] *Fishery Research and Education Institutions of North and South America* published in November 1950.

an international meeting on the design and construction of fishing boats. The Division is currently ascertaining whether there is interest in holding such a meeting.

## Expanded Technical Assistance Program

Under its technical assistance program, FAO has officers in the field carrying out projects in fisheries biology, technology and economics as well as discussing projects for future developments in these fields [1].

Dr. Bottemanne has begun a survey of the fisheries and fisheries industries of Brazil. Alan Glanville has studied fisheries problems in Ceylon and has discussed fishing experiments with local authorities. Together with J. O. Traung, he has worked out a proposal for engines and gear to be used in these experiments and FAO is taking steps towards the procurement of this material. J. Fridtjof is conducting a marketing survey of the Chilean fishing industry and is currently studying a project for a new fishing company. FAO is procuring a supply of hydrographic equipment for Dr. Schweigger to carry out a general survey of Ecuadorian fisheries.

S.Y Lin reports a good rate of growth in carp which he has been cultivating in Haiti. He is now getting fry from the United States to stock village ponds. The Tilapia which were imported from Jamaica a few months ago have already propagated and a number of them will be ready for distribution within the next few months; various local people have become interested in cultivating this fish. L. Bonnefil, who has been S.Y Lin's chief Haitian assistant in this project, has been awarded a technical assistance fellowship and is now in Indonesia studying fish culture techniques.

An agreement providing for the training of two fellows in fish cultural techniques has been signed between FAO and Israel and the program is being arranged. C. Serbetis is in Libya assessing the sponge fisheries to determine means of further development. A decision has been reached regarding the location of the proposed fishing harbor in Karachi, Pakistan, and A. van den Berg and H. van Pel expect to have their plans for the harbor completed before the end of their four months assignment. Dr.S.W. Ling has begun work on inland fisheries in Thailand.

[1] See *FAO Fisheries Bulletin*, Volume 4, Nos. 3 and 4.

# Notes on Films

WHALING. Producer: G. B. Instructional Ltd., Imperial Studios, Elstree Way, Boreham Wood, Hertfordshire, England. Distributor: G. B. Equipments Ltd., Mortimer House, Mortimer Street, London, W. 1. For distribution outside the United Kingdom special arrangements are made in each individual case. Technical data: 16 mm., balck and white, sound; 448 feet, 13 minutes running time; commentary and titles in English. Price: 16 mm. print, sound £ 17.10.0d., silent £ 13. 5. 0d. Rental in the United Kingdom: 15 s. 0d. first day.

Introductory remarks are made on the magnitude of the operation of a whale factory ship. Animated diagrams show the route of a factory ship from Southampton, England, to Cape Town, where the whale catchers join the factory ship, and then to the Antarctic whaling grounds. Here the fleet encounters icebergs and very thick ice. Unusual shots show the factory with refueling catchers alongside and a scouting plane, used for spotting of whales, being catapulted from the deck. An actual pursuit and capture is shown in detail, with viewpoint changing from plane to catcher, and with good action shots. The manner in which the whale is killed with the second harpoon and blown up with compressed air is shown. Many whales are brought back and tied alongside the factory ship. They are seen being hauled aboard and flensed. The bones are separated with saws. An oil tanker is shown coming down to refuel the factory ship and to take back whale oil. Whaling operations under adverse weather conditions are also shown.

This film gives a well-rounded and interesting account of Antarctic whaling operations.

*M. J.*

OTTER TRAWLING. Producer: Fisheries Division, Department of Trade and Industry, Halifax, Nova Scotia, Canada. Distributor: Nova Scotia Bureau of Information, Provincial Building, Halifax, Nova Scotia, Canada. Technical data: 16 mm., color, sound, 800 feet; 20 minutes running time; commentary and titles in English. Price: 16 mm., color print: approximately Can. $135. Rental: free.

Shows in great detail how otter trawling is carried out on the Grand Banks east of Canada. It is filmed aboard a large trawler, but the principle of the gear and fishing methods is essentially the same on smaller boats. Animated diagrams give detailed accounts of the various parts of the trawl, describing their functions. It is then seen how a trawler is outfitted for a fishing trip and how the net is prepared on the trip to the fishing grounds; the setting and hauling of the net is shown in great detail. The operations are repeated in the film in

order that the audience may have a good understanding of them It is then shown how the catch is taken aboard, gutted, washed, and iced in the holds. Such details are given of the fishing operations that the film is particularly useful for an audience interested in fishing technique.

*M. J.*

FISHERMEN OF THE ATLANTIC. Producer : Fisheries Division, Department of Trade and Industry, Halifax, Nova Scotia, Canada. Distributor : Nova Scotia Bureau of Information, Provincial Building, Halifax, Nova Scotia, Canada. Technical data : 16 mm., color, sound, 400 feet ; 10 minutes running time ; commentary and titles in English. Price ; 16 mm., color print: approximately Can. $75. Rental: free.

An abridged version of the above-mentioned film, " Otter Trawling. " Gives a general description of the otter trawl and its operation and the work on the fishing grounds. The operations are shown only once and in less detail than in the above-mentioned film, as the present edition is intended for general information purposes.

*M. J.*

THE DUNGENESS CRAB. Producer and distributor : Haines Oyster Company, Pier 4, Seattle 47, Washington, U.S.A. Technical data: 16 mm., color, silent, 16 minutes running time, titles in English. Rental free. As original has been used several times, it is not recommended for printing.

Shows how dungeness crabs are caught and stored in large live boxes and then transported in wooden boxes to the picking plants. Shows, partly in slow motion, how the crabs are opened and cooked and how the meat is picked and brined.

The opening and picking of whole crabs, which are shipped without the back shell, are also shown. Probably of less general interest is the rather considerable part of the film related to the table display of prepared crab dishes, etc. Although presumably an amateur film, it contains several interesting details. Some of the procedures shown in it are probably not in accordance with modern sanitary practices.

*M. J.*

# Notes on Publications

FWS 9.2 FISHERIES STATISTICS — U.S.A. UDC 31 (73)

California Division of Fish and Game, Bureau of Marine Fisheries. *The*
1951 *Commercial Fish Catch of California for the Years* 1948-1949 *with Yield per Area of the California Sardine Fishing Grounds* 1937-1949. Fish Bulletin No. 80. California State Printing Office, Sacramento, California, U.S.A. 87 pp., 9 fig. In English.

Contains a report on the yield per area of the California sardine fishing grounds from 1937 to 1949, and statistical tables giving by month the weight and value of the different species of fish landed in California. Statistical information on the California fishermen and fishing fleet are also included.

M.J.G.

FWS 9.2 FISHERIES STATISTICS — FRANCE UDC 31:639.2 (44)

France, Ministère des Travaux publics et des transports, Sous-Secrétariat
1950 d'Etat à la marine marchande, Direction des pêches maritimes. *Statistiques des pêches maritimes*, Année 1948 (Marine Fisheries Statistics, Year 1948). Imprimerie Nationale, Paris, 177 pp. In French.

Deals with the situation in France of the fishing fleet, number of craft in each port with a break-down by tonnage, means of propulsion, horse-power, kind of fuel utilized, and kind of gear operated; quantities and values of fish landed in each port with a break-down by species ; fishermen ; and related industries, such as shipyards and plants for drying, canning, salting, freezing, reduction, etc.

M.J.G.

FWS 9.11 OCEAN UDC 551.46

Dunbar, M. J. *Eastern Artic Waters*. Bulletin No.88. Fisheries Research
1951 Board of Canada, Ottawa, Canada. 131 pp. 32 fig., tables, map. In English.

Summary of existing knowledge on physical oceanography of the Canadian eastern Arctic region, from Hudson Bay to Cape Farewell and from Belle Isle to Smith Sound. The following aspects of the oceanography of the area are recounted : bathymetry, sediments, water masses, horizontal distribution of temperature and salinity, circulation, fjords and other inlets, seasonal cycles, long-term changes, Arctic and sub-Arctic. Some biological material is presented ; tidal times and conditions are omitted. Points out fields of oceanography in the area most in need of study and makes recommendations for further study.

H.R.,Jr.

FWS 9.11 OCEAN — SOUTHERN AFRICA UDC 551.46 (68)

Clowes, A. J. *An Introduction to the Hydrology of South African Waters*.
1950 Investigational Report No. 12. Fisheries and Marine Biological Survey Division, Department of Commerce and Industries, Pretoria, Union of South Africa. 42 pp., 14 fig,. 20 charts. In English.

An attempt to clarify the complicated pattern of the water masses and their movements which affect fisheries on the coast of the Union of South Africa and of South West Africa. The area delimited by 20° and 45° S. and 5° W. and 45° E. has been selected for this study. Only observations from the " Discovery Investigations, 1925-39 " and from the " Deutsche Atlantische Expedizion, Meteor, 1925-27 " were examined and used in the present analysis. The data have been examined by the method of temperature-salinity relationship. The information assembled will prove useful to fishery biologists working on problems within the area.

B.F.O.T.

FWS 9.1 FRESH WATER BIOLOGY UDC 57

Carlander, Kenneth D. *Handbook of Fresh-water Fishery Biology.* Wm.
1950 C. Brown Company, Dubuque, Iowa, U.S.A. 281 pp., 4 nomographs. In English.

A source book for quick reference to data on fresh water fishes. The author reviewed 1,115 publications on inland fisheries and extracted, as completely as possible, all exact information on the life history of some 180 species and varieties of fresh water fishes found in the United States and Canada. In 220 pages of tables all available data are summarized on the growth, length, weight and the various length relationships with a 14 page introduction of instructions for reading. Conversion tables and a painstakingly compiled bibliography on fresh-water fishery biology make this publication a comprehensive *vade mecum* for every limnologist and fisheries biologist.

W.H.S.

FWS 7.8 FOOD EXAMINATION — FRESHNESS TESTS UDC 614.31

Japan, Tokai Regional Fisheries Research Laboratory. *Bulletin* Contri-
1950 bution A., No.1. Tsukishima, Tokyo. December 1950. 140 pp., illus., tables. In Japanese, with English summary.

The first of a series, this Bulletin contains a chemical study on the freshness test of aquatic food products by Keishi Amano.

H.R.,Jr.

FWS 1 FISHERIES — GERMANY UDC 639.2 (43)

Deutscher Fischerei - Almanach 1951 (German Fisheries Almanac 1951).
1951 Krögers Buch-und Verlagsdruckerei, Hamburg-Blankenese, Germany. 296 pp., tables. In German. Price DM. 4.50.

This is the first postwar edition of a handbook, published regularly until World War II. It covers the Federal Republic of Germany and provides a guide on navigational and other regulations regarding the German coast and its harbors as well as information on lighthouses, etc., in other countries, visited by German vessels. It also contains a list of German fishing craft with information on length, tonnage, propulsion, etc., processing, as well as wholesale firms in German ports.

G.M.G.

FWS 1.0141 FISHERIES — NORWAY UDC 639.21 (481)

Sandvaer, Gerh. *Lofotfisket* 1950 (Annual Report on Lofoten Fishery
1951 1950). Fiskeridirektøren, Årsberetning vedkommende Norges Fiskerier, 1951, No. 1. Cammermeyers Boghandel, Oslo, Norway. 94 pp. In Norwegian.

The most recent annual report in a long series on the spawning cod (skrei) fishery at the Lofoten Islands in northern Norway. In addition to a week by week textual account of how the season developed regarding weather and occurrence of fish, the report contains special surveys for each port. Catch statistics are given by port and fishing methods. Statistics on fishermen, craft and gear are given by ports as of 22 March 1950, the traditional enumeration date as the season is then presumably at its peak.

G.M.G.

FWS 1.015 FISHERIES — JAPAN UDC 639.2 (52)

Bourgois, François. *Japanese Off-shore Trawling.* Fishery Leaflet 389.
1951 United States Department of the Interior, Fish and Wildlife Service, Washington, D.C., U.S.A., Feb. 1951. 60 pp., fig., tables, bibl. In English. Free.

A reproduction of Report No. 138, Natural Resources Section, General Headquarters, Supreme Commander for the Allied Powers, Tokyo, Japan, issued in December 1950. This report gives an over-all picture of the Japanese off-shore trawling operations before World War II. Three types of trawl are described— the otter trawl, towed by one vessel ; the bull (pareja) trawl, towed by two vessels ; and a trawl somewhat like the Danish seine, which, in Japan, is both hauled and towed. Diagrams and specifications are given for typical trawls, their design, operation and the boats using them. Other chapters deal with fisheries regulations, combined operations of trawlers and factory ships, exploratory trawling expeditions, and the Japanese trawling operations since 1946.

J.O.T.

FWS 1 FISHERIES — JAPAN UDC 639.2 (52)

Herrington, William C. *A Program for Japanese Coastal Fisheries.* Prelim-
1951 inary Study No. 48. Natural Resources Section, General Headquarters, Supreme Commander for the Allied Powers, Tokyo, Japan. May 1951, 73 pp., 10 appendices. (Republished as Fishery Leaflet 395 by the United States Department of the Interior, Fish and Wildlife Service, Washington, D. C., U.S.A., June 1951).

A basic five point program designed to cover the minimum requirements to meet the growing economic crisis of the Japanese coastal fisheries. In the appendices appear extracts of official reports of visiting experts, consultants in the field of fisheries, as well as reports of the staff members of the Fisheries Division of the Natural Resources Section, and reports previously published by the author.

H.R.,Jr.

FWS 1 FISHING — JAPAN UDC 639.2 (52)

United States Department of the Interior, Fish and Wildlife Service.
1951 *Special Scientific Reports : Fisheries* Nos. 42-52. Washington, D.C., U.S.A., January 1951. In English.

A series of papers selected from Japanese publications, and translated into English. Includes No. 42, *Tuna Fishing in Palau Waters* (26 pp.); No. 43, *Fishing Conditions South of the Marshall Islands* (23 pp.) ; No. 44, *Tuna Bait Resources at Saipan* (15 pp.) ; No. 45, *Exploratory Tuna Fishing in Indonesian Waters* (17 pp.) ; No. 46, *Exploratory Tuna Fishing in the Caroline Islands* (42 pp.) ; No. 47, *Exploratory Tuna Fishing in the Marshall Islands* (21 pp.) ; No. 48, *Japanese Tuna Surveys in tropical waters* (40 pp.) ; No. 49, *The Japanese Skipjack Fishery* (67 pp.) ; No. 50,

*Kishinouye's Order Plecostei* (16 pp.); No. 51, *Japanese Skipjack Studies* (51 pp.); No 52, *On the Japanese Black Tuna (Thunnus orientalis)* (22 pp.). Several of these publications include more than one short article.

H. R., Jr.

FWS 1 FISHERIES RESOURCES — TURKEY UDC 639.2 (56)

United States Department of the Interior, Fish and Wildlife Service.
1951 *Fishery Resources of Turkey.* Fishery Leaflet 390. Washington, D. C., U.S.A., May 1951, 24 pp., illus. In English.

The information in this leaflet was supplied by Miss Bertha Carp, American Consulate General, Istanbul, Turkey. Gives location of fisheries regions, a list of Turkish fish and shellfish with English, Turkish and scientific names, fishing methods, with illustrations of gill and trammel nets, fixed traps, and beach and purse seines. Tables give quantities of fish sold by auctions, exports, and principal types of fishing craft. Also illustrated with line drawings of 3 standard types of rowing boats. Suggestions are given for the development of the industry.

J.O.T.

FWS 1.015 FISHERIES — FEDERATION OF MALAYA AND SINGAPORE UDC 639.2 (595:595.13)

Le Mare, D. W. *Report of the Fisheries Department, Malaya, 1949.* Gov-
1950 ernment Publications Bureau, General Post Office, Fullerton Building, Singapore. 211 pp., illus., tables, graphs. In English. Price Straits $2.

A statement of conditions, with comments on the fisheries of Malaya for 1949.

*Part I*, dealing with Pan-Malayan Headquarters, contains six chapters covering analyses of economic factors affecting the industry..

*Part II*, gives a statement of conditions affecting the fisheries situation in each one of the 11 states of the Federation and contains miscellaneous information on local subjects.

*Part III*, the "Department of Fisheries, Singapore," by T.W. Burdon, the Fisheries Officer, deals with the current situation and future prospects of the Singapore fishing activities with emphasis on the production and distribution of fresh fish. Several statistical tables give detailed analyses of material presented throughout the report. An annex provides a glossary of local fishing terms, a list of Malayan fish names, and a scientific description of fish and other aquatic animals. Also published separately under the title of *Extract from the Report of the Fisheries Department, Malaya, 1949*.

J.A.

FWS 1 FISHERIES RESEARCH — JAPAN UDC 639.2.0015 (52)

Rich, Willis H. *Fisheries Research Program of Japan.* Preliminary Study
1951 No. 42. Natural Resources Section, General Headquarters, Supreme Commander for the Allied Powers, Tokyo, Japan. January 1951, 40 pp., 1 appendix. In English.

Presents an analysis of the general features of the Japanese fisheries research program; a study of important research on herring, salmon and Inland Sea fisheries and the trawl fishery in the East China Sea; includes a summary of recommendations and the structure of the Fisheries Agency of Japan, with the names and addresses of the eight major regional laboratories. This study was made with the purpose of helping the Japanese to develop a sound, modern fisheries research program. In the appendix, an abstract of the paper *Scientific Method, Its Function in Research and in Education*, by Dr. T. Lee Kelley, is presented.

H.R.,Jr.